

**SEARCH REQUEST FORM****Scientific and Technical Information Center**

Requester's Full Name: Rayman) Alvarado Examiner #: 76895 Date: 04/05/04  
 Art Unit: 1745 Phone Number 345-71172 - (2nd Serial Number: 01) 970104  
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If more than one search is submitted, please prioritize searches in order of need.

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Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc., if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Humidifier for Fuel Cell

Inventors (please provide full names): Suzuki et al.

Earliest Priority Filing Date: 10/03/01

\*For Sequence Searches Only\* Please include all pertinent information (parent, child, divisional, or issued parent numbers) along with the appropriate serial number.

Please, search for subject matter of claims 1-15.  
 (attached copy).

<b>STAFF USE ONLY</b>		<b>Type of Search</b>	<b>Vendors and cost where applicable</b>
Searcher:	<u>EJ</u>	NA Sequence (#):	STN <u>\$219.03</u>
Searcher Phone #:		AA Sequence (#):	Dialip
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Date Searcher Picked Up:	<u>14-6-04</u>	Bibliographic:	Dr Link
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Onsite Time:	<u>82</u>	Other	Other (specify):

=> file home  
FILE 'HOME' ENTERED AT 16:39:13 ON 06 APR 2004

=> display history full 11-

FILE 'HCA, WPIX, JAPIO' ENTERED AT 16:27:13 ON 06 APR 2004  
L1        40578 SEA FUELCELL? OR FUEL?(2A) (CELL OR CELLS)  
L2        22573 SEA FUELCELL? OR FUEL?(2A) (CELL OR CELLS)  
L3        15047 SEA FUELCELL? OR FUEL?(2A) (CELL OR CELLS)  
TOTAL FOR ALL FILES  
L4        78198 SEA FUELCELL? OR FUEL?(2A) (CELL OR CELLS)  
L5        4806 SEA HUMIDIF?  
L6        11042 SEA HUMIDIF?  
L7        6983 SEA HUMIDIF?  
TOTAL FOR ALL FILES  
L8        22831 SEA HUMIDIF?  
L9        14280 SEA HOLLOW?(2A) (FIBER? OR FIBRE? OR FILAMENT? OR STRAND?  
            OR THREAD? OR RIBBON? OR FILIFORM? OR TUBUL?)  
L10       15506 SEA HOLLOW?(2A) (FIBER? OR FIBRE? OR FILAMENT? OR STRAND?  
            OR THREAD? OR RIBBON? OR FILIFORM? OR TUBUL?)  
L11       5271 SEA HOLLOW?(2A) (FIBER? OR FIBRE? OR FILAMENT? OR STRAND?  
            OR THREAD? OR RIBBON? OR FILIFORM? OR TUBUL?)  
TOTAL FOR ALL FILES  
L12       35057 SEA HOLLOW?(2A) (FIBER? OR FIBRE? OR FILAMENT? OR STRAND?  
            OR THREAD? OR RIBBON? OR FILIFORM? OR TUBUL?)  
L13       710 SEA L1 AND L5  
L14       514 SEA L2 AND L6  
L15       398 SEA L3 AND L7  
TOTAL FOR ALL FILES  
L16       1622 SEA L4 AND L8  
L17       30 SEA L13 AND L9  
L18       38 SEA L14 AND L10  
L19       15 SEA L15 AND L11  
TOTAL FOR ALL FILES  
L20       83 SEA L16 AND L12  
L21       291 SEA HUMID?(5A) ((REACT? OR RX# OR RXN# OR SUPPLY? OR  
            SUPPLIES OR SUPPLIED) (3A) (GAS## OR GASEOUS? OR GASIF?))  
L22       401 SEA HUMID?(5A) ((REACT? OR RX# OR RXN# OR SUPPLY? OR  
            SUPPLIES OR SUPPLIED) (3A) (GAS## OR GASEOUS? OR GASIF?))  
L23       229 SEA HUMID?(5A) ((REACT? OR RX# OR RXN# OR SUPPLY? OR  
            SUPPLIES OR SUPPLIED) (3A) (GAS## OR GASEOUS? OR GASIF?))  
TOTAL FOR ALL FILES  
L24       921 SEA HUMID?(5A) ((REACT? OR RX# OR RXN# OR SUPPLY? OR  
            SUPPLIES OR SUPPLIED) (3A) (GAS## OR GASEOUS? OR GASIF?))  
L25       3524 SEA (LIQ# OR LIQUID? OR LIQUEF? OR FLUID? OR FLU!FACT?) (2  
            A) (EXHAUST? OR EFFLUENT? OR EFFLUVI?)  
L26       6981 SEA (LIQ# OR LIQUID? OR LIQUEF? OR FLUID? OR FLU!FACT?) (2

A) (EXHAUST? OR EFFLUENT? OR EFFLUVI?)  
L27 1733 SEA (LIQ# OR LIQUID? OR LIQUEF? OR FLUID? OR FLU!FACT?) (2  
A) (EXHAUST? OR EFFLUENT? OR EFFLUVI?)  
TOTAL FOR ALL FILES  
L28 12238 SEA (LIQ# OR LIQUID? OR LIQUEF? OR FLUID? OR FLU!FACT?) (2  
A) (EXHAUST? OR EFFLUENT? OR EFFLUVI?)  
L29 159 SEA L13 AND L21  
L30 114 SEA L14 AND L22  
L31 105 SEA L15 AND L23  
TOTAL FOR ALL FILES  
L32 378 SEA L16 AND L24  
L33 2 SEA L13 AND L25  
L34 2 SEA L14 AND L26  
L35 2 SEA L15 AND L27  
TOTAL FOR ALL FILES  
L36 6 SEA L16 AND L28  
L37 14 SEA L17 AND L21  
L38 11 SEA L18 AND L22  
L39 7 SEA L19 AND L23  
TOTAL FOR ALL FILES  
L40 32 SEA L20 AND L24  
  
FILE 'HCA' ENTERED AT 16:37:15 ON 06 APR 2004  
L41 16 SEA L33 OR L37  
L42 15 SEA L17 NOT L41  
  
FILE 'WPIX' ENTERED AT 16:37:46 ON 06 APR 2004  
L43 12 SEA L34 OR L38  
L44 27 SEA L18 NOT L43  
  
FILE 'JAPIO' ENTERED AT 16:38:19 ON 06 APR 2004  
L45 9 SEA L35 OR L39  
L46 8 SEA L19 NOT L45

=> file hca  
FILE 'HCA' ENTERED AT 16:39:26 ON 06 APR 2004  
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L41 ANSWER 1 OF 16 HCA COPYRIGHT 2004 ACS on STN  
140:114255 Apparatus and method for **humidifying** gases. Saito,  
Takahiro (Asahi Glass Engineering Co., Ltd., Japan). Jpn. Kokai

Tokkyo Koho JP 2004028490 A2 20040129, 10 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2002-187910 20020627.

- AB The app. has **humidifying zones** in a case and a steam contg. **humidifying gas**, supplied from an inlet, flowing through the zones successively; where the **humidifying zones** have **humidifying gas passages** formed by polymer membranes having different steam permeability, with the zones closer to the **humidifying gas** inlet having passages made of lower steam permeability membranes. The membranes may be **hollow fibers**. A gas, esp. a solid **electrolyte fuel cell reaction** gas, is **humidified** by passing the app. to indirectly contact the **humidifying gas**.
- IC ICM F24F006-04  
ICS F24F006-00; H01M008-04; H01M008-10
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
- ST fuel cell reaction gas  
humidifying method app
- IT Fuel cells  
Humidity  
(membrane permeation app. and method for **humidifying**  
**reaction gases for fuel cells**  
)

L41 ANSWER 2 OF 16 HCA COPYRIGHT 2004 ACS on STN  
140:62364 **Humidifier for fuel cell**.

Tanihara, Nozomu; Yoshinaga, Toshimune (Ube Industries, Ltd., Japan). PCT Int. Appl. WO 2004004044 A1 20040108, 39 pp.

DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (Japanese). CODEN: PIXXD2. APPLICATION: WO 2003-JP6711 20030528. PRIORITY: JP 2002-159891 20020531.

- AB The **humidifier** comprises: a **hollow-fiber** bundle, composed of a large no. of **hollow fiber** membranes, and tube plates for fixing both ends of the bundle; mounted on a container having at least a 1st gas inlet and outlet and a 2nd gas inlet and outlet, and spaces through the outside of the membranes and through the hollow side sep'd.; where the **hollow-fiber** membrane has an inside diam. of  $\geq 400 \mu\text{m}$ , a water vapor permeability rate ( $P' \text{ H}_2\text{O}$ ) of  $\geq 0.5 \times 10^{-3} \text{ cm}$ , a water vapor to O gas permeability rate ratio of  $\geq 10$ , and a tensile fracture extensibility of

$\geq 80\%$  after the membrane was treated in 100° hot water for 50 h. The **humidifier** is used for **humidifying** a **supply gas** to the **fuel cell**

- IC ICM H01M008-04  
ICS H01M008-10
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
- ST fuel cell humidifier structure  
hollow fiber membrane characteristics control
- IT Polyimides, uses  
(hollow fiber membrane; **humidifiers**  
contg. hollow fiber membranes with controlled  
characteristics for fuel cells)
- IT Fuel cells  
Humidity  
(**humidifiers** contg. hollow fiber  
membranes with controlled characteristics for fuel  
cells)

L41 ANSWER 3 OF 16 HCA COPYRIGHT 2004 ACS on STN  
 138:306098 Hollow-fiber membrane module and  
 manufacture of same.. Hayashi, Takahiro; Namikata, Kazuhiko (NOK  
 Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2003112016 A2 20030415, 6  
 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-309119  
 20011004.

AB In title app. including a casing, plural **hollow-fiber** membranes arranged in the casing, potting section(s) at the end portion(s) of the casing for sealing the gaps between the inner wall of the casing and the outer wall surfaces of the **hollow-fiber** membranes, the potting section(s) is composed of plural layers having different hardness. In the potting section(s), a low hardness layer (e.g., silicone) is arranged at the innermost side of the casing, and a high hardness layer (e.g., epoxy resin) having hardness higher than that of the low hardness layer is arranged at the outer side of the low hardness layer. The **hollow-fiber** membrane module can be used for supplying **humidified** gas to **fuel cells**, etc.

- IC ICM B01D063-02  
ICS B01D053-22; B01D061-00; B01D063-00; F24F006-08; H01M008-04
- CC 48-1 (Unit Operations and Processes)  
Section cross-reference(s): 38, 52
- ST hollow fiber membrane module manuf potting layer  
different hardness; fuel cell humidified  
gas supply hollow fiber  
membrane module
- IT Membranes, nonbiological  
(hollow-fiber; hollow-fiber

membrane module and manuf. of same)

IT Fuel cells

(humidified gas for; hollow-fiber  
membrane module and manuf. of same for supply of)

IT Gases

(humidified, supply of; hollow-  
fiber membrane module and manuf. of same)

IT Epoxy resins, uses

Polysiloxanes, uses  
(layer, potting section contg.; hollow-fiber  
membrane module and manuf. of same)

IT Potting compositions

(layers, of different hardness; hollow-fiber  
membrane module and manuf. of same)

IT Potting

(low and high hardness layers for; hollow-fiber  
membrane module and manuf. of same)

IT Hardness (mechanical)

(of potting layers; hollow-fiber membrane  
module and manuf. of same)

L41 ANSWER 4 OF 16 HCA COPYRIGHT 2004 ACS on STN

138:155476 Hollow-fiber membrane module..

Takahashi, Yoshihide (Nok Corp., Japan). Jpn. Kokai Tokkyo Koho JP  
2003038938 A2 20030212, 7 pp. (Japanese). CODEN: JKXXAF.

APPLICATION: JP 2001-232548 20010731.

AB The title app. includes a cylindrical module casing, a  
hollow-fiber membrane bundle, which is formed by  
bundling plural hollow-fiber membranes, filled  
in the module casing, and 1st and 2nd paths passing through the  
inside and outside of the hollow-fiber  
membranes, resp.; the hollow-fiber membrane  
module is wrapped by a nonwoven fabric, and filled into the module  
casing at the nonwoven fabric-wrapped state to facilitate the  
filling process. The app. can be used for, e.g.,  
humidifying fuel gas and supplying the  
humidified fuel gas to solid polymer fuel  
cells, etc.

IC ICM B01D063-02

ICS B01D053-22; F24F006-08; H01M008-04; H01M008-10

CC 47-2 (Apparatus and Plant Equipment)

Section cross-reference(s): 52

ST hollow fiber membrane module nonwoven fabric  
wrapped bundle; fuel cell fuel gas  
humidification hollow fiber membrane  
module

IT Water vapor

(adding of, of fuel gas; hollow-fiber

membrane module for **humidifying** fuel gas of solid polymer fuel cells)

- IT Containers  
(casing; **hollow-fiber** membrane module with nonwoven fabric wrapped membrane bundle in module casing)
- IT Nonwoven fabrics  
(for wrapping membrane bundle; **hollow-fiber** membrane module with nonwoven fabric wrapped membrane bundle in module casing)
- IT Membranes, nonbiological  
(**hollow-fiber**; **hollow-fiber** membrane module with nonwoven fabric wrapped membrane bundle in module casing)
- IT Fuel gases  
(humidification of; **hollow-fiber** membrane module for **humidifying** fuel gas of solid polymer fuel cells)
- IT Fuel cells  
(polymer electrolyte; **hollow-fiber** membrane module for **humidifying** fuel gas of solid polymer fuel cells)

L41 ANSWER 5 OF 16 HCA COPYRIGHT 2004 ACS on STN  
137:313541 Membrane tubing **humidifiers** for fuel cell use. Smith, T. Paul; Leighty, David A. (USA). U.S. Pat. Appl. Publ. US 2002155328 A1 20021024, 10 pp. (English). CODEN: USXXCO. APPLICATION: US 2001-839748 20010420.

AB In **humidifying** the fuel input to a fuel cell, a stream of dry inlet gas is passed inside the strands of liq. permeable tubes. A stream of hot wet exhaust gas from the fuel cell or hot cooling water from the fuel cell is passed over the outside of the tubing bundle in a counter-current flow direction. Water vapor from the hot wet exhaust gas or liq. water from the hot cooling water is absorbed onto the outside surface of the permeable tubing, permeates through the walls of the tubing, and pervaporates into the dry gas stream inside the tubing. At the same time, heat from the exhaust gas or cooling water is conducted through the tubing walls into the dry gas stream inside. The permeation of water also carries heat with it, increasing the efficiency of heat recovery and transfer into the inlet fuel/oxidant gas.

IC ICM H01M008-04  
NCL 429013000  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 47  
ST fuel cell use membrane tubing **humidifier**  
IT Exhaust gases (engine)  
Fuel cells

Membranes, nonbiological  
 Pipes and Tubes  
 (membrane tubing humidifiers for fuel  
 cell use)

L41 ANSWER 6 OF 16 HCA COPYRIGHT 2004 ACS on STN  
 137:297399 Hollow fiber membrane humidifier

. Shimanuki, Hiroshi; Katagiri, Toshikatsu; Suzuki, Mikihiro; Kusano, Yoshio (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2002298895 A2 20021011, 11 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-101416 20010330.

AB The humidifier, for fuel cell reaction gases, has a bundle of hollow fiber membrane, for water vapor exchange between 2 fluid flowing inside and outside the fibers, resp., fixed in a housing having inlet and outlet holes for the fluid flowing outside the fibers, where the total area of the inlet holes is smaller than the total area of the outlet holes. Another structure of the humidifier has a pipe connected to a distribution chamber, for supplying a fluid flowing inside of fibers, where the narrowest part of the pipe has a cross-sectional area smaller than the total cross-section hole areas of the fibers.

IC ICM H01M008-06

ICS B01D063-02; F24F006-00; F24F006-04; H01M008-04; H01M008-10

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST fuel cell reaction gas

IT hollow fiber membrane humidifier

IT Membranes, nonbiological  
 (hollow-fiber; structure of hollow fiber membrane humidifiers for reaction gases for fuel cells)

IT Fuel cells

Humidity  
 (structure of hollow fiber membrane humidifiers for reaction gases for fuel cells)

L41 ANSWER 7 OF 16 HCA COPYRIGHT 2004 ACS on STN

137:297345 Fuel cell humidifier and method

of using it. Hayashi, Takahiro; Namikata, Kazuhiko (NOK Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2002289229 A2 20021004, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-83326 20010322.

AB The humidifier has a tubular pipe and a concentrically tubular case, both having an opening in their wall surfaces, a bundle of hollow fiber membranes filled in between, a 1st passage connecting the inside of the pipe to the case opening via the opening on the pipe, a 2nd passage passing through the voids inside the membrane, a fuel gas flow supplied to a solid

polymer fuel cell through 1 passage, and a water vapor contg. gas flowing in the other passage for humidifying the fuel gas; where the membrane bundle is a wound up membrane and is filled together with the pipe in the case. The humidifier is used by humidifying fuel gas supplied to fuel cells by fuel cell off gas.

- IC ICM HO1M008-04  
 ICS HO1M008-04; B01D053-22; B01D063-02; B01D071-64; F24F006-00;  
 HO1M008-10
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST fuel cell hollow fiber  
 membrane humidifier structure application
- IT Membranes, nonbiological  
 (hollow-fiber; structure of and method for  
 using hollow fiber membranes  
 humidifiers for polymer electrolyte fuel  
 cells)
- IT Fuel cells  
 Humidity  
 (structure of and method for using hollow fiber  
 membranes humidifiers for polymer electrolyte  
 fuel cells)

L41 ANSWER 8 OF 16 HCA COPYRIGHT 2004 ACS on STN  
 137:297344 Fuel cell humidifier and method  
 for using the humidifier. Saito, Masaharu; Nakayama,  
 Tomohiro (NOK Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2002289228  
 A2 20021004, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP  
 2001-83325 20010322.

AB The humidifier has a hollow polyimide  
 fiber membrane sepg. water vapor from gases for  
 humidifying a fuel gas supplied to a  
 solid polymer fuel cell. Preferably, the  
 membrane has a polyalc. dip coating and been heated at  
 90-120°. The humidifier is used by supplying a  
 fuel cell off gas as water vapor source for  
 humidifying the fuel gas.

- IC ICM HO1M008-04  
 ICS HO1M008-04; B01D053-22; B01D063-02; B01D071-64; HO1M008-06;  
 HO1M008-10; F24F006-04
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST polyimide hollow fiber membrane polyalc coating  
 humidifier fuel cell
- IT Membranes, nonbiological  
 (hollow-fiber; polyimide hollow  
 fiber membrane humidifiers for  
 humidifying fuel cell fuel

- gas by off gases)
- IT Humidity  
 (humidifiers contg. imide hollow fiber membrane with polyalc. coating for fuel cells)
- IT Polyimides, uses  
 (polyamide-; polyimide hollow fiber membrane humidifiers for humidifying fuel cell fuel gas by off gases)
- IT Polyimides, uses  
 (polyether-; polyimide hollow fiber membrane humidifiers for humidifying fuel cell fuel gas by off gases)
- IT Fuel cells  
 Water vapor  
 (polyimide hollow fiber membrane humidifiers for humidifying fuel cell fuel gas by off gases)
- IT Polyamides, uses  
 Polyethers, uses  
 (polyimide-; polyimide hollow fiber membrane humidifiers for humidifying fuel cell fuel gas by off gases)
- IT 56-81-5, Glycerin, uses 57-55-6, 1,2-Propanediol, uses  
 (polyalc. dip coated polyimide hollow fiber membrane humidifiers for humidifying fuel cell fuel gas by off gases)

L41 ANSWER 9 OF 16 HCA COPYRIGHT 2004 ACS on STN  
 136:387820 Humidification apparatus for adding moisture to  
 gases to be supplied to fuel  
 cells. Okada, Keiji (Nok Corp., Japan). Jpn. Kokai Tokkyo  
 Koho JP 2002147802 A2 20020522, 6 pp. (Japanese). CODEN: JKXXAF.  
 APPLICATION: JP 2000-338025 20001106.

AB The title app. includes a bottomed inner casing, a concentrically arranged outer casing, and hollow-fiber membranes arranged in the annular gap between the outer and inner casings. In the app., the following paths are provided: (1) 1st path: from one end side of the hollow-fiber membranes passing through their hollow inner portions to the other end side of the hollow-fiber membranes, and (2) 2nd path: from 1st opening section, which is arranged on the side wall surface of the inner casing, passing through the gaps among the outer walls of the hollow-fiber membranes to 2nd opening section, which is arranged on side wall surface of the outer casing; the gas to be humidified is flowed through the 1st path (or 2nd path) and a moisture-contg. gas is flowed through the other path, or vice versa. The gas to be humidified is

reactant gas (e.g., H<sub>2</sub> and/or O<sub>2</sub>) of fuel cells. The hollow-fiber membranes are made of polymers, e.g., polyimides. The fuel cells are solid polymer-type fuel cells.

IC ICM F24F006-04  
ICS B01D053-22; B01D053-26; B01D063-02; F24F006-00; H01M008-04;  
H01M008-10

CC 47-5 (Apparatus and Plant Equipment)

Section cross-reference(s): 51, 52

ST humidifier hollow fiber membrane gas moisture addn fuel cell; fuel cell reactant gas moisture addn humidification app; hydrogen moisture addn humidification app fuel cell; oxygen moisture addn humidification app fuel cell

IT Water vapor  
(addn. of; humidification app. with hollow-fiber membranes for adding moisture to gases to be supplied to fuel cells)

IT Membranes, nonbiological  
(hollow-fiber; humidification app. with hollow-fiber membranes for adding moisture to gases to be supplied to fuel cells )

IT Fuel cells  
(humidification app. with hollow-fiber membranes for adding moisture to gases to be supplied to fuel cells)

IT Gases  
(humidification of, app. for; humidification app. with hollow-fiber membranes for adding moisture to gases to be supplied to fuel cells )

IT Polyimides, uses  
Polymers, uses  
(membranes, hollow-fiber; humidification app. with hollow-fiber membranes for adding moisture to gases to be supplied to fuel cells)

IT 1333-74-0, Hydrogen, processes 7782-44-7, Oxygen, processes  
(humidification of, app. for; humidification app. with hollow-fiber membranes for adding moisture to gases to be supplied to fuel cells )

controlled humidification state. Suzuki, Mikihiro; Shimanuki, Hiroshi; Katagiri, Toshikatsu; Kusano, Yoshio (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2002117879 A2 20020419, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-306742 20001005.

- AB A fuel cell system comprises a fuel cell, humidifying means installed in reaction gas supply channel and supplying water to the fuel cell, a separator installed in the released gas channel and sepg. the released gas into gas and liq., a bypass channel for supplying the reaction gas to the fuel cell so as to bypass the humidifying means, a case provided in the bypass channel for storing the water obtained in the separator, a hollow fiber membrane installed in the case, and means for heating the case, the hollow fiber membrane, and the inside of the case. The fuel cell is in the prescribed humidified state even when it is started.
- IC ICM H01M008-04  
ICS H01M008-10
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST solid electrolyte fuel cell system controlled humidification state
- IT Humidity  
Solid state fuel cells  
(solid-electrolyte fuel cell system with controlled humidification state)

- L41 ANSWER 11 OF 16 HCA COPYRIGHT 2004 ACS on STN  
136:250326 Humidifier for fuel cell.  
Suzuki, Motohiro; Shimanuki, Hiroshi; Katagiri, Toshikatsu; Kusano, Yoshio (Honda Giken Kogyo Kabushiki Kaisha, Japan). U.S. Pat. Appl. Publ. US 20020039674 A1 20020404, 23 pp. (English). CODEN: USXXCO. APPLICATION: US 2001-970104 20011003. PRIORITY: JP 2000-305317 20001004.
- AB A humidifier for fuel cell of the present invention comprises a hollow fiber membrane module in which a hollow fiber membrane bundle, comprising hollow fiber membranes bundled together, is accommodated inside a housing. The module comprises an entrance head which supplies off-gas inside the hollow fiber membranes, an exit head which converges off-gas, which has passed through the hollow fiber membranes, at another end of the hollow fiber membrane module, and an exhaust exit which exhausts liq., accumulated in the entrance head. According to this humidifier, it is possible to prevent the hollow fiber membranes from becoming blocked by water.
- IC ICM H01M008-04

ICS H01M008-10  
NCL 429030000  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST fuel cell humidifier hollow fiber  
membrane  
IT Membranes, nonbiological  
    (hollow-fiber; water-permeable humidifier for  
    fuel cell)  
IT Fuel cells  
    (water-permeable humidifier for fuel  
    cell)

L41 ANSWER 12 OF 16 HCA COPYRIGHT 2004 ACS on STN  
135:125050 Humidifying system for fuel cell  
. Katagiri, Toshikatsu; Shimanuki, Hiroshi; Suzuki, Motohiro;  
Kusano, Yoshio (Honda Giken Kogyo Kabushiki Kaisha, Japan). U.S.  
Pat. Appl. Publ. US 20010010871 A1 20010802, 10 pp. (English).  
CODEN: USXXCO. APPLICATION: US 2001-774373 20010130. PRIORITY: JP  
2000-23225 20000131.

AB In a **humidifying system for a fuel cell**,  
, the system producing a highly wet air by allowing dry air to pass  
through a water permeable **humidifier**, and  
**supplying** the highly wet gas to a **fuel**  
**cell**, the **humidifying system** comprises a  
supercharger between an inlet for introducing gas into the  
fuel cell and an outlet for releasing gas from the  
**humidifier**. Since the pressure at the inlet of the  
supercharger is lower than the pressure at the outlet, the flow-  
velocity at the inlet is higher than the flow velocity at the  
outlet. Therefore, the flow velocity of the dry air which flows  
inside the **humidifier** can be increased so as to be higher  
than the flow velocity in the case where the supercharger is  
provided between the inlet for introducing gas into the **fuel**  
**cell** and a gas intake opening. Accordingly, the efficiency  
of **humidification** is improved, and the sizes of the  
**humidifier** and the supercharger can be reduced.

IC ICM H01M008-02  
    ICS H01M008-10  
NCL 429012000  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST humidifying system fuel cell  
IT Membranes, nonbiological  
    (hollow-fiber, water-permeable;  
    humidifying system for fuel cell)  
IT Fuel cells  
    (humidifying system for fuel cell)

L41 ANSWER 13 OF 16 HCA COPYRIGHT 2004 ACS on STN

135:109734 **Humidifiers for polymer electrolyte fuel cells.** Katagiri, Toshikatsu; Shimanuki, Hiroshi; Suzuki, Mikihiko; Kusano, Yoshio (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001201122 A2 20010727, 16 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-10974 20000119.

AB The **humidifiers** have 2 gases with different moisture content flowing sep. inside and outside a water permeable **hollow fiber membrane**, where the flow directions of the 2 gases cross each other.

IC ICM F24F006-04

ICS B01D053-22; B01D063-02; B01D069-08; F24F006-00; H01M008-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST polymer electrolyte fuel cell reaction  
gas humidifier

IT Fuel cells

Humidity

(cross flow hollow fiber membrane  
humidifiers for polymer electrolyte fuel  
cells)

L41 ANSWER 14 OF 16 HCA COPYRIGHT 2004 ACS on STN

135:109733 **Humidifiers for fuel cell**

**reaction gases.** Suzuki, Mikihiko; Kusano, Yoshio; Shimanuki, Hiroshi; Katagiri, Toshikatsu (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001201120 A2 20010727, 11 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-10969 20000119.

AB The **humidifiers** have a water permeable **hollow fiber membrane** installed along the length direction in a housing, gas flows of different moisture content passing along the membrane inside and outside the fibers for moisture exchange, and inlet and outlet for the gas flowing outside the fibers near the ends of the housing. The **humidifiers** are esp. useful for polymer electrolyte fuel cells.

IC ICM F24F006-04

ICS B01D053-22; B01D063-02; F24F006-00; H01M008-04; H01M008-10

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST polymer electrolyte fuel cell reaction  
gas humidifier

IT Fuel cells

Humidity

(structure of water permeable hollow fiber  
membrane humidifiers for fuel cell  
reaction gases)

L41 ANSWER 15 OF 16 HCA COPYRIGHT 2004 ACS on STN

126:62760 **Humidifiers for reaction gases**

**supplied to solid polymer electrolyte fuel  
cells.** Fujikawa, Futoshi; Hasegawa, Yasuaki; Watanabe,

Shogo (Mazda Motor, Japan). Jpn. Kokai Tokkyo Koho JP 08273687 A2 19961018 Heisei, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1995-73864 19950330.

- AB The **humidifiers** are **hollow fiber** membrane devices for contacting the reaction gas with water or the cathode off gas from the cells. The **humidifiers** may have a **reaction gas** chamber and a water chamber connected to the cooling water pipe for the cells.
- IC ICM H01M008-04  
ICS H01M008-10
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST solid polymer electrolyte fuel cell  
humidifier; fuel cell reaction  
gas humidifier; hollow fiber  
humidifier fuel cell
- IT Fuel cells  
(hollow fiber membrane humidifiers  
for reaction gases supplied to  
solid polymer electrolyte fuel cells)
- IT Membranes, nonbiological  
(hollow-fiber; hollow fiber  
membrane humidifiers for reaction  
gases supplied to solid polymer electrolyte  
fuel cells)
- IT Air conditioning  
(humidification; hollow fiber  
membrane humidifiers for reaction  
gases supplied to solid polymer electrolyte  
fuel cells)

L41 ANSWER 16 OF 16 HCA COPYRIGHT 2004 ACS on STN

124:33704 Fuel cell stacks with **reaction**  
**gas humidifying** means. Ishimaru, Yoichi; Mizuno,  
Seiji (Toyota Motor Co Ltd, Japan). Jpn. Kokai Tokkyo Koho JP  
07245116 A2 19950919 Heisei, 9 pp. (Japanese). CODEN: JKXXAF.  
APPLICATION: JP 1994-64518 19940307.

- AB In **fuel cell** stacks having a passage for recycling a cooling water, the water passage is made in contact with reaction gas supplying passages for the cell electrodes, where at least part of the contacting area is composed of a water permeable membrane. The membrane may be a porous layer having higher permeability for water than for the reaction gas or a **hollow fiber** membrane.
- IC ICM H01M008-04  
ICS H01M008-10
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST fuel cell reaction gas  
humidifying

IT Fuel cells  
(reaction gas humidifying means for  
water cooled fuel cell stacks)  
IT Membranes  
(hollow-fiber, MHF; reaction  
gas humidifying means for water cooled  
fuel cell stacks)

=> file wpix  
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L43 ANSWER 1 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
AN 2003-793925 [75] WPIX

DNN N2003-636328

TI Gas humidification apparatus for fuel  
cell, has fixed shaft that carries out screw coupling with  
pair of base materials, to assemble hollow fiber  
membrane with the base materials.

DC Q74 X16

PA (NIOD) NOK CORP

CYC 1

PI JP 2003240284 A 20030827 (200375)\* 8p F24F006-08

ADT JP 2003240284 A JP 2002-40258 20020218

PRAI JP 2002-40258 20020218

IC ICM F24F006-08

ICS F24F006-00

AB JP2003240284 A UPAB: 20031120

NOVELTY - The apparatus has a hollow fiber  
membrane module (10) inserted into recesses (21) of a pair of base  
materials (20,30), and engaged with the base materials. A fixed  
shaft (40) that is fixed to the module and base materials, has  
portions (41,42) that carry out screw coupling with the base  
materials.

USE - For humidifying the gas  
supplied to fuel cell.

ADVANTAGE - The hollow fiber membrane is  
easily and reliably attached to and detached from the gas  
humidification apparatus.

DESCRIPTION OF DRAWING(S) - The figure shows a schematic view

of the assembly operation of the gas humidification apparatus.

- humidification apparatus 1
- hollow fiber membrane module 10
- base materials 20,30
- recesses 21
- screw hole 22
- through hole 31
- screw 32
- fixed shaft 40
- shaft portions 41,42

Dwg.2/8

FS EPI GMPI  
 FA AB; GI  
 MC EPI: X16-C09

L43 ANSWER 2 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2003-341322 [32] WPIX  
 DNN N2003-273016

TI Humidifying system for polymer electrolyte fuel cell, has ejector to mix portion of anode exhaust gas with fuel gas, using negative pressure resulting from flow of fuel gas.

DC X16

IN KATAGIRI, T; SHIMANUKI, H; SUZUKI, M  
 PA (HOND) HONDA MOTOR CO LTD; (HOND) HONDA GIKEN KOGYO KK

CYC 2

PI US 2003008189 A1 20030109 (200332)\* 13p H01M008-04  
 JP 2003017101 A 20030117 (200353) 8p H01M008-04

ADT US 2003008189 A1 US 2002-190072 20020703; JP 2003017101 A JP 2001-204286 20010705

PRAI JP 2001-204286 20010705

IC ICM H01M008-04  
 ICS H01M008-10

AB US2003008189 A UPAB: 20030820

NOVELTY - A humidifier (2) transfers moisture of cathode exhaust gas discharged from the cathode to the fuel gas, through hollow filler membranes. Another humidifier (3) transfers moisture of cathode exhaust gas discharged from the humidifier (2) to oxidant gas, through hollow fiber membrane. An ejector (4) mixes portion of the anode exhaust gas with the fuel gas using the negative pressure resulting from flow of fuel gas.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for a method of humidifying gases supplied to the fuel cell.

USE - Humidifying system including supersonic humidifier, nozzle injection humidifier, steam humidifier for fuel cells e.g. polymer

**electrolyte fuel cells.**

**ADVANTAGE** - Retains balance between **humidification** of fuel gas and oxidant gas. Avoids increase in pressure fluctuation, thus durability of **hollow fiber** membrane is improved. Provides a simple structure, thus maintenance and inspection is carried out easily.

**DESCRIPTION OF DRAWING(S)** - The figure shows a block diagram of the **humidifying system for fuel cell**.

**humidifiers** 2,3

**ejector** 4

Dwg.1/9

FS

EPI

FA

AB; GI

MC

EPI: X16-C01C; X16-C09

L43 ANSWER 3 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-206981 [20] WPIX

DNN N2003-165431

TI **Hollow fiber** membrane module for **humidifier**, has module case into which **hollow fiber** membrane bundle wrapped in non-woven fabric is provided.

DC Q74 X16

PA (NIOD) NOK CORP

CYC 1

PI JP 2003038938 A 20030212 (200320)\* 7p B01D063-02

ADT JP 2003038938 A JP 2001-232548 20010731

PRAI JP 2001-232548 20010731

IC ICM B01D063-02

ICS B01D053-22; F24F006-08; H01M008-04; H01M008-10

AB JP2003038938 A UPAB: 20030324

**NOVELTY** - A **hollow fiber** membrane bundle (3) is wrapped in a non-woven fabric (4) and then inserted into a module case (2).

**USE** - For **humidifier** to **humidify** heating gas supplied to solid polymer fuel cell, etc.

**ADVANTAGE** - **Hollow fiber** membrane is prevented from damage during man hour.

**DESCRIPTION OF DRAWING(S)** - The figure shows **hollow fiber** membrane module.

module case 2

**hollow fiber** membrane bundle 3

    non-woven fabric 4

Dwg.1/11

FS

EPI GMPI

FA

AB; GI

MC

EPI: X16-C01; X16-C09

L43 ANSWER 4 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2003-090974 [08] WPIX  
 DNN N2003-071919  
 TI **Humidifying module has plumbing whose bottom is provided with protrusion which opposes fluid flow direction.**  
 DC Q52 Q72 Q74 T06 X16 X21  
 IN KATAGIRI, T; KUSANO, Y; SHIMANUKI, H; SUZUKI, M  
 PA (HOND) HONDA GIKEN KOGYO KK; (HOND) HONDA MOTOR CO LTD  
 CYC 4  
 PI US 2002139320 A1 20021003 (200308)\* 17p F22B037-22  
     CA 2379429 A1 20020930 (200308) EN F24F006-02  
     DE 10214078 A1 20021017 (200308) B01D063-02  
     JP 2002292233 A 20021008 (200308) 10p B01D053-22  
     US 6669177 B2 20031230 (200402) B01F003-04  
 ADT US 2002139320 A1 US 2002-103723 20020325; CA 2379429 A1 CA  
     2002-2379429 20020327; DE 10214078 A1 DE 2002-10214078 20020328; JP  
     2002292233 A JP 2001-101415 20010330; US 6669177 B2 US 2002-103723  
     20020325  
 PRAI JP 2001-101415 20010330  
 IC ICM B01D053-22; B01D063-02; B01F003-04; F22B037-22; F24F006-02  
     ICS F02D041-00; F02D043-00; F02D045-00; F24F006-00; F24F006-04  
 ICA H01M008-04; H01M008-06; H01M008-10  
 AB US2002139320 A UPAB: 20030204  
 NOVELTY - A plumbing (2) is inserted into **hollow fiber** bundle (1b), with insertion length shorter than the length of bundle. A protrusion provided at the bottom of the plumbing, opposes flow direction of fluid streaming the inside of plumbing.  
 USE - **Humidifying module for fuel cell.**  
 ADVANTAGE - The occurrence of the remained fluid can be prevented, thus fracture of the plumbing caused by the freeze of remained water and cooling down of high temperature gas discharged from **fuel cell** by remained water is prevented. Therefore, the module brings the efficient output responsibility and start-up responsibility to the **fuel cell**, even if it is adopted to humidification of the **gas supplied to the fuel cell**. Obtains module with superior workability since shape of the plumbing in cylinder and protrusion is made cone. Since the fluid comes to be supplied over the whole **hollow fiber** module with sufficient fluid distribution towards the radius direction, the usability of the **hollow fiber** is improved.  
 DESCRIPTION OF DRAWING(S) - The figure shows the perspective view of the **humidifying module**.  
 Dwg.1A/11  
 FS EPI GMPI

FA AB; GI  
 MC EPI: T06-B07; X16-C; X16-C09; X21-A01F; X21-B01A

L43 ANSWER 5 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2003-081938 [08] WPIX  
 DNN N2003-064282

TI **Humidification** module for fuel cell in electric vehicle, humidifies air and hydrogen gas flowing through respective hollow fiber membranes by exchanging water content between air, hydrogen gas and humidification gas.

DC Q74 X16 X21

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2002298882 A 20021011 (200308)\* 1lp HO1M008-04

ADT JP 2002298882 A JP 2001-99476 20010330

PRAI JP 2001-99476 20010330

IC ICM HO1M008-04

ICS F24F006-00; HO1M008-10

AB JP2002298882 A UPAB: 20030204

NOVELTY - A partition (17) separates hollow-fiber membranes (P1,P2). **Humidification gas** (MG) supplied from center of the module passes through holes (31) in partition. Air (Ad) and hydrogen gas (Hd) flowing through the respective hollow fiber membrane are humidified by exchanging water content between air, hydrogen gas and humidification gas.

USE - Humidification module for solid electrolyte fuel cell is electric vehicle.

ADVANTAGE - Improves the **humidification** efficiency by reducing the calorie released from the module, thereby improving the electricity-generation efficiency of fuel cell.

DESCRIPTION OF DRAWING(S) - The figure shows a sectional view of the humidification device.

Air Ad

Hollow-fiber membranes P1,P2

Hydrogen gas Hd

Humidification gas MG

Partition 17

Hole 31

Dwg.2/9

FS EPI GMPI

FA AB; GI

MC EPI: X16-C01; X16-C09; X16-C15; X21-A01F; X21-B01A

L43 ANSWER 6 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2003-081937 [08] WPIX  
 DNN N2003-064281

TI Fuel cell system has pure-water flow path for supplying pure water to **humidifier**, that is arranged such that pure water is heated by high temperature fluid ejected from **fuel cell stack**.  
 DC X16  
 PA (NSMO) NISSAN MOTOR CO LTD  
 CYC 1  
 PI JP 2002298880 A 20021011 (200308)\* 7p H01M008-04  
 ADT JP 2002298880 A JP 2001-95428 20010329  
 PRAI JP 2001-95428 20010329  
 IC ICM H01M008-04  
 ICS H01M008-06; H01M008-10  
 AB JP2002298880 A UPAB: 20030204  
 NOVELTY - A pure-water flow path (12a) for supplying pure water to a **humidifier** (2), is arranged such that pure water is heated by a high temperature fluid such as **exhaust gas** ejected from a **fuel cell stack** (1) through a high temperature fluid flow path (12b).  
 USE - **Fuel cell system**.  
 ADVANTAGE - Pure water is supplied to the **humidifier** stably and is heated quickly.  
 DESCRIPTION OF DRAWING(S) - The figure shows the **fuel cell system**.

**Fuel cell stack 1**  
**Humidifier 2**  
 Pure-water flow path 12a  
 High temperature fluid flow path 12b

Dwg.1/8

FS EPI  
 FA AB; GI  
 MC EPI: X16-C01; X16-C09

L43 ANSWER 7 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2003-052020 [05] WPIX  
 DNN N2003-041319 DNC C2003-013592  
 TI **Humidifier for solid polymer fuel cell**, has **hollow fiber** membrane bundle made of tire fabric and film wound together on pipe.  
 DC J01 L03 Q74 X16  
 PA (NIOD) NOK CORP  
 CYC 1  
 PI JP 2002289229 A 20021004 (200305)\* 9p H01M008-04  
 ADT JP 2002289229 A JP 2001-83326 20010322  
 PRAI JP 2001-83326 20010322  
 IC ICM H01M008-04  
 ICS B01D053-22; B01D063-02; B01D071-64; F24F006-00; H01M008-10  
 AB JP2002289229 A UPAB: 20030121  
 NOVELTY - A **hollow fiber** membrane bundle (4)

made of tire fabric and a film (6) are wound together on a pipe (3).  
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for the use of a **humidifier**.

USE - Used as a **humidifier** for humidifying combustion **gas supplied** to a solid polymer fuel used in an electricity generation system.

ADVANTAGE - The strength of the **humidifier** is increased, and **humidification efficiency** are improved, while improving the gas exchange rate.

DESCRIPTION OF DRAWING(S) - The figure shows a partial perspective view of the **humidifier**.

Pipe 3

Hollow fiber membrane bundle 4

Film 6

Dwg.1/14

FS CPI EPI GMPI

FA AB; GI

MC CPI: J01-E02C; L03-E04A2

EPI: X16-C01C

L43 ANSWER 8 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
AN 2003-052019 [05] WPIX

DNN N2003-041318 DNC C2003-013591

TI Combustion gas **humidifier** for solid polymer fuel cell, has **hollow fiber** membrane containing imide group material.

DC J01 L03 Q74 X16

PA (NIOD) NOK CORP

CYC 1

PI JP 2002289228 A 20021004 (200305)\* 7p H01M008-04

ADT JP 2002289228 A JP 2001-83325 20010322

PRAI JP 2001-83325 20010322

IC ICM H01M008-04

ICS B01D053-22; B01D063-02; B01D071-64; H01M008-06; H01M008-10

ICA F24F006-04

AB JP2002289228 A UPAB: 20030121

NOVELTY - A **humidifier** comprises a **hollow fiber** membrane (2), including imide group material.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for the use of the **humidifier**.

USE - For **humidifying combustion gas supplied** to a solid polymer fuel cell.

ADVANTAGE - The **humidifier** provides sufficient **humidification**, improving the use value of the **humidifier**.

DESCRIPTION OF DRAWING(S) - The figure shows a perspective view of the **humidifier**.

Hollow fiber membrane 2

Dwg.1/9  
 FS CPI EPI GMPI  
 FA AB; GI  
 MC CPI: J01-E02C; L03-E04A2  
 EPI: X16-C01C

L43 ANSWER 9 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2002-467244 [50] WPIX  
 DNN N2002-368391  
 TI Fuel cell system, includes reactive gas flow path that by-passes a reactive gas humidifier to supply reactive gas to the fuel cell.  
 DC X16  
 PA (HOND) HONDA MOTOR CO LTD  
 CYC 1  
 PI JP 2002117879 A 20020419 (200250)\* 7p HO1M008-04  
 ADT JP 2002117879 A JP 2000-306742 20001005  
 PRAI JP 2000-306742 20001005  
 IC ICM HO1M008-04  
 ICS HO1M008-10  
 AB JP2002117879 A UPAB: 20020807  
 NOVELTY - A vapor separator (15) separates the exhaust gas emitted by a fuel cell (11) into its gas and liquid components. A reactive gas flow path (22) bypasses a reactive gas humidifier (14) to supply reactive gas to the fuel cell. The reactive gas circulates in a hollow fiber membrane soaked in water inside the housing. A heating humidifier (16) heats the interior of the housing, including the hollow fiber membrane.

USE - Fuel cell system.

ADVANTAGE - Enables instant supply of reactive gas with high moisture to the fuel cell. Improves electricity generating efficiency. Ensures that housing interior does not overheat by preventing direct heating of the hollow fiber membrane.

DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the fuel cell system.

Fuel cell 11

- Reactive gas humidifier 14
- Vapor separator 15
- Heating humidifier 16
- Reactive gas flow path 22

Dwg.1/4

FS EPI  
 FA AB; GI  
 MC EPI: X16-C01; X16-C09

L43 ANSWER 10 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2002-403990 [43] WPIX  
 DNN N2002-317088

TI Water permeable humidifier for fuel cell  
 has cathode humidifying unit to transfer water in off gas  
 through hollow fiber structures to reactive gas  
 to be supplied to fuel cell.

DC X16

IN KATAGIRI, T; KUSANO, Y; SHIMANUKI, H; SUZUKI, M  
 PA (HOND) HONDA MOTOR CO LTD; (HOND) HONDA GIKEN KOGYO KK

CYC 2

PI US 2002039674 A1 20020404 (200243)\* 23p H01M008-04  
 JP 2002184440 A 20020628 (200258) 15p H01M008-04

ADT US 2002039674 A1 US 2001-970104 20011003; JP 2002184440 A JP  
 2001-309154 20011004

PRAI JP 2000-305317 20001004

IC ICM H01M008-04

ICS B01D063-02; H01M008-06; H01M008-10

AB US2002039674 A UPAB: 20020709

NOVELTY - A hollow fiber membrane module  
 circulates a reactive gas to be supplied to a fuel  
 cell inside a housing and outside the hollow  
 fiber structures, and circulates an off-gas through a flow  
 entrance (9) into the hollow fiber structures. A  
 cathode humidifying unit (5A) transfers the water in the  
 off-gas through the hollow fiber structures to  
 the reactive gas and humidifies the  
 reactive gas.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for  
 fuel cell system.

USE - Water permeable humidifier for fuel  
 cell.

ADVANTAGE - The cathode humidifying unit  
 exhausts liquid which has accumulated in the  
 off-gas flow entrance, to prevent or reduce blocking of the  
 hollow fiber structures by water. Therefore the  
 number of hollow fiber structures for  
 humidification is increased, reduction in flow path area of  
 the off gas is reduced and increase in pressure loss of off-gas is  
 prevented.

DESCRIPTION OF DRAWING(S) - The figure shows a block diagram of  
 the humidifier.

Cathode humidifying unit 5A  
 Off-gas flow entrance 9

Dwg.1/17

FS EPI

FA AB; GI

MC EPI: X16-C01C; X16-C09; X16-C15; X16-K

L43 ANSWER 11 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2001-579876 [65] WPIX  
 DNN N2001-431688

TI **Humidification system for fuel cell of electric vehicle, includes detection device to detect generation of clogging in between tube type hollow threads when discharge and supply gases pass through hollow threads.**

DC W05 X16 X21

IN KATAGIRI, T; KUSANO, Y; SHIMANUKI, H; SUZUKI, M  
 PA (HOND) HONDA MOTOR CO LTD; (HOND) HONDA GIKEN KOGYO KK  
 CYC 2

PI US 2001010496 A1 20010802 (200165)\* 14p G08B021-00  
 JP 2001216982 A 20010810 (200165) 8p H01M008-04  
 US 6545609 B2 20030408 (200327) G08B021-00

ADT US 2001010496 A1 US 2001-771723 20010129; JP 2001216982 A JP 2000-23221 20000131; US 6545609 B2 US 2001-771723 20010129

PRAI JP 2000-23221 20000131

IC ICM G08B021-00; H01M008-04  
 ICS H01M008-10

AB US2001010496 A UPAB: 20011108

**NOVELTY - The humidifier** including a bundle of tube type **hollow threads** made of water permeable membrane, transfers the water content in a discharge gas of **fuel cell**, to a supply gas of **fuel cell**, when one of the discharge gas and supply gas is passed through interior and between **hollow threads** respectively. A detection device comprising manometers (P1-P4) detects clogging generation in or between the threads.

USE - For **fuel cell** of electric vehicle.

ADVANTAGE - Detects clogging in **humidifier** quickly, so that the affect to stack caused by the decrease in **humidification** of a **supply gas** due to clogging in the **humidifier** is suppressed to minimal level, thereby preventing the failure of **fuel cell**.

DESCRIPTION OF DRAWING(S) - The figure shows block diagram for explaining the function of a **humidification system** for a **fuel cell**.

Manometers P1-P4

Dwg. 2/13

FS EPI

FA AB; GI

MC EPI: W05-B01A5; W05-D03; W05-D07D; X16-C09; X16-H; X21-A01F;  
 X21-A05; X21-B01A

L43 ANSWER 12 OF 12 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2001-531412 [59] WPIX  
 DNC C2001-158475  
 TI Hollow fiber gas separation membrane for gas separation has an asymmetric membrane composed of skin and porous layers and is made from a blend of two or more different polymers including at least one polyimide.  
 DC A26 A88 J01  
 IN ITO, K; KUSUKI, Y; NAKANISHI, S; YOSHINAGA, T  
 PA (UBEI) UBE IND LTD  
 CYC 29  
 PI EP 1118371 A1 20010725 (200159)\* EN 16p B01D053-22  
     R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK  
     NL PT RO SE SI TR  
     JP 2001269553 A 20011002 (200172) 7p B01D069-08  
     CN 1317362 A 20011017 (200213) B01D053-22  
     US 2002035922 A1 20020328 (200225) B01D053-22  
     JP 2002172311 A 20020618 (200255) 10p B01D053-22  
     US 6464755 B2 20021015 (200271) B01D053-22  
 ADT EP 1118371 A1 EP 2001-100017 20010104; JP 2001269553 A JP  
     2000-125587 20000426; CN 1317362 A CN 2001-116239 20010119; US  
     2002035922 A1 US 2001-766116 20010119; JP 2002172311 A JP  
     2000-370031 20001205; US 6464755 B2 US 2001-766116 20010119  
 PRAI JP 2000-370031 20001205; JP 2000-9877 20000119; JP 2000-125587  
     20000426  
 IC ICM B01D053-22; B01D069-08  
     ICS B01D053-26; B01D063-02; B01D069-00; B01D069-02; B01D069-10;  
     B01D071-64; H01M008-04; H01M008-10  
 ICA F24F006-04  
 AB EP 1118371 A UPAB: 20011012  
 NOVELTY - A gas separation membrane with an asymmetric structure composed of a skin layer and a porous layer, a water vapor permeation rate ( $P'_{H2O}$ ) of  $2.5 \times 10^{-3} \text{ cm}^3 (\text{STP})/\text{cm}^2.\text{sec}.\text{cmHg}$  or greater and a water vapor and nitrogen permeation rate ratio ( $P'_{H2O}/P'_{N2}$ ) of 50 or greater, where the helium gas permeation rate ( $P'_{He}$ ) of the porous (support) layer of the membrane is  $3.0 \times 10^{-3} \text{ cm}^3 (\text{STP})/\text{cm}^2.\text{sec}.\text{cmHg}$  or greater, the tensile strength as a hollow fiber membrane is 2.5 kgf/mm<sup>2</sup> or greater and the breaking elongation is 10% or greater.  
 DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for a method which uses the gas separation membrane for dehumidification and/or humidification of a fuel cell supply gas.  
 As asymmetric hollow fibre membrane was made by filtering a polyimide (blend) solution was filtered with a 400 mesh wire net and then extruded from a hollow fiber membrane spinning nozzle (1000 micro m circular opening diameter, 200 micro m circular opening slit width, 400 micro m core opening diameter) and the extruded hollow

**fiber** body was passed through a nitrogen atmosphere and then immersed in a coagulation bath comprising an aqueous ethanol with a prescribed concentration (70-80 wt. %) at a temperature of 0 deg. C to make wet fibers. The fibers were immersed for 2 hours in ethanol at a temperature of 50 deg. C to complete desolvating treatment, and after further immersion for 3 hours in ethanol in isoctane at a temperature of 70 deg. C to replace the solvent. It was dried at a prescribed temperature (200-300 deg. C). All of the resulting **hollow fiber** membranes had an outer diameter of approximately 470 micro m, an inner diameter of approximately 320 micro m and a membrane thickness of approximately 75 micro m.

USE - The membrane is used in (de)humidification methods, or in gas separation methods (claimed).

ADVANTAGE - The gas separation membranes have very good water resistance as well as hot water resistance. The membranes give highly efficient gas separation and provide a more compact and more efficient high performance **hollow fiber** gas separation membrane separation module, due to an improved gas separation rate.

Dwg.0/0

TECH EP 1118371 A1 UPTX: 20011012

TECHNOLOGY FOCUS - CHEMICAL ENGINEERING - Preferred membrane: The breaking elongation of the **hollow fiber** membrane after hot water treatment in 100degreesC hot water for 50 hours is at least 80% of that before the hot water treatment.

TECHNOLOGY FOCUS - PHARMACEUTICALS - Preferred membrane material: The membrane is composed of a blend of two or more different polymers including at least one polyimide.

FS	CPI
FA	AB
MC	CPI: A05-J01B; A07-A03; A07-A04F; A12-E06B; A12-W11A; J01-C03; J01-E01; J01-H
PLE	UPA 20011012 [1.1] 018; P1081-R F72 D01; S9999 S1207 S1070 [1.2] 018; ND01; Q9999 Q7410 Q7330; Q9999 Q8060; B9999 B5221 B4740; B9999 B4171 B4091 B3838 B3747; B9999 B3907 B3838 B3747; K9745-R; K9483-R; K9687 K9676; K9712 K9676

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FILE LAST UPDATED: 1 MAR 2004 <20040301/UP>

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L45 ANSWER 1 OF 9 JAPIO (C) 2004 JPO on STN  
 ACCESSION NUMBER: 2003-017105 JAPIO  
 TITLE: COOLING DEVICE FOR FUEL CELL  
 INVENTOR: USHIO TAKESHI; IMAZEKI MITSUHARU; SHIMOHAMA  
 YOSHIRO  
 PATENT ASSIGNEE(S): HONDA MOTOR CO LTD  
 PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2003017105	A	20030117	Heisei	H01M008-04

#### APPLICATION INFORMATION

STN FORMAT:	JP 2001-203938	20010704
ORIGINAL:	JP2001203938	Heisei
PRIORITY APPLN. INFO.:	JP 2001-203938	20010704
SOURCE:	PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2003	

AN 2003-017105 JAPIO

AB PROBLEM TO BE SOLVED: To aim at an improvement of humidifying property and moisture exhausting property of a fuel cell.

SOLUTION: The cooling device for a fuel cell comprises a fuel cell 1 generating electricity by using hydrogen and air as reaction gases; a humidifiers 3, 7 humidifying the reaction gases to be supplied to the fuel cell 1; a cooling liquid circuit 12, cooling the fuel cell 1 by making cooling liquid circulate between the fuel cell 1 and a radiation device 11 by a water pump 15, and radiating the heat of the cooling liquid to outside by a radiator 11; a heating means (3d, 7d), heating the humidifiers 3, 7 by the cooling liquid exhausted from the fuel cell 1; and a controlling means controlling the water pump 15 so as to keep a prescribed temperature difference between the temperature at the outlet and at the inlet of the cooling liquid of the fuel cell 1.

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IC ICM H01M008-04

ICS H01M008-02; H01M008-10

L45 ANSWER 2 OF 9 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER:	2003-017101	JAPIO
TITLE:	HUMIDIFYING SYSTEM FOR FUEL CELL	
INVENTOR:	KATAGIRI TOSHIKATSU; SHIMANUKI HIROSHI; SUZUKI	

MIKIHIRO  
 PATENT ASSIGNEE(S): HONDA MOTOR CO LTD  
 PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2003017101	A	20030117	Heisei	H01M008-04

## APPLICATION INFORMATION

STN FORMAT: JP 2001-204286 20010705  
 ORIGINAL: JP2001204286 Heisei  
 PRIORITY APPLN. INFO.: JP 2001-204286 20010705  
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2003

AN 2003-017101 JAPIO

AB PROBLEM TO BE SOLVED: To provide a **humidifying system** for a **fuel cell** enabled to properly balance a **humidification level** between **fuel gas** and **oxidation gas supplied to the fuel cell** even when the output of the **fuel cell** becomes large.

SOLUTION: The **humidifying system** for the **fuel cell** comprises a **fuel cell** 1 in which, electricity is generated by supplying **fuel gas** to an **anode electrode la** and **oxidation gas** to a **cathode electrode lc** respectively, and by making the **gases react** with each other; a **first humidifier** making the moisture in **cathode-off gas** exhausted from the **first humidifier** move into the **fuel gas** through a **hollow fiber membrane**; a **second humidifier** making the moisture in **cathode-off gas** passed through the **first humidifier** move into the **oxidation gas** through a **hollow fiber membrane**; a **reduced pressure generating device** arranged between the **first humidifier** and the **fuel cell**, making the **anode-off gas** exhausted from the **anode electrode la** flow together with the **fuel gas** by using a negative pressure generated by the flow of the **fuel gas**.

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IC ICM H01M008-04

ICS H01M008-10

L45 ANSWER 3 OF 9 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2002-292233 JAPIO

TITLE: HUMIDIFYING MODULE

INVENTOR: SHIMANUKI HIROSHI; KATAGIRI TOSHIKATSU; SUZUKI MIKIHIRO; KUSANO YOSHIO

PATENT ASSIGNEE(S): HONDA MOTOR CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002292233	A	20021008	Heisei	B01D053-22

**APPLICATION INFORMATION**

STN FORMAT: JP 2001-101415 20010330  
 ORIGINAL: JP2001101415 Heisei  
 PRIORITY APPLN. INFO.: JP 2001-101415 20010330  
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2002

AN 2002-292233 JAPIO

AB PROBLEM TO BE SOLVED: To provide a **humidifying module** which generates no pool at its bottom part even when a fluid in which steam and condensed water coexist is made to flow in an inner passage and which has excellent output respondecny and excellent starting property of a **fuel cell** even when applied to **humidification of supply gas supplied to the fuel cell in a humidifying module which accommodates hollow fiber membrane bundles of water transmissive type inside and is provided with the inner passage with a bottom at its nearly central part.**

SOLUTION: The **humidifying module 1** is provided with the **hollow fiber** membrane bundle **1b** through which water can be exchanged between fluids respectively flowing inside and outside the membrane and the inner passage (a pipe **2**) with the bottom which has an entrance part **2a** and an exit part **2b** through which the fluid can go in and out and extends in a longitudinal direction with length shorter than that of the **hollow fiber** membrane bundle at nearly central part in a thickness direction of the **hollow fiber** membrane bundle **1b**. Further a projected part **2c** is provided in a direction against the fluid flow at a bottom **bs** provided near the exit part **2b** of the inner passage (the pipe **2**).

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IC ICM B01D053-22

ICS B01D063-02; F24F006-00; F24F006-04

ICA H01M008-04; H01M008-06; H01M008-10

L45 ANSWER 4 OF 9 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2002-075422 JAPIO

TITLE: HUMIDIFIER FOR FUEL CELL

INVENTOR: SUZUKI MIKIHIRO; KUSANO YOSHIO; SHIMANUKI HIROSHI; TONEGAWA SEIJI

PATENT ASSIGNEE(S): HONDA MOTOR CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002075422	A	20020315	Heisei	H01M008-04

**APPLICATION INFORMATION**

STN FORMAT: JP 2000-265692 20000901  
 ORIGINAL: JP2000265692 Heisei  
 PRIORITY APPLN. INFO.: JP 2000-265692 20000901  
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2002

AN 2002-075422 JAPIO

AB PROBLEM TO BE SOLVED: To provide a **humidifier** for a fuel cell sufficiently humidifying a supply gas, with a good humidifying efficiency, enabled to sufficiently collect moisture in an exhaust gas.

SOLUTION: The **humidifier** has a hollow **thread** membrane module 21 making the moisture contained in an exhaust air Ae exhausted from the **fuel cell** 1 permeate into the side of a supply air A to be supplied to the **fuel cell** 1, and the flowing volume of the exhaust air Ae flowing inside the hollow **thread** membrane module 21 is made so as to become bigger than the volume of the supply air A. Further, the **humidifier** has two hollow **thread** membranes 21a, 21b which are arranged serially with each other at the exhaust air Ae side, and in parallel with each other at the supply air A side.

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IC ICM H01M008-04

ICS B01D053-22; B01D063-02; F24F006-00; F24F006-04; H01M008-06

L45 ANSWER 5 OF 9 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2002-075419 JAPIO

TITLE: HUMIDIFYING DEVICE FOR FUEL CELL

INVENTOR: KUSANO YOSHIO; KATAGIRI TOSHIKATSU; SHIMANUKI HIROSHI; SUZUKI MIKIHIRO

PATENT ASSIGNEE(S): HONDA MOTOR CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002075419	A	20020315	Heisei	H01M008-04

**APPLICATION INFORMATION**

STN FORMAT: JP 2000-264704 20000831  
 ORIGINAL: JP2000264704 Heisei

PRIORITY APPLN. INFO.: JP 2000-264704 20000831  
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2002

AN 2002-075419 JAPIO

AB PROBLEM TO BE SOLVED: To provide a **humidifying device** for a **fuel cell** with a combining structure securing insulation distance.

SOLUTION: With the **humidifying device** for the **fuel cell** provided with an inlet end and an outlet end for exhaust gas discharged from the **fuel cell** and with a plurality of **humidifying units** for furnishing **gas supplied to the fuel cell**

with moisture contained in the exhaust gas for **humidifying**, a first plate (an outside plate 3a) equipped over each inlet end of the above plurality of **humidifying units** ( **hollow fiber membrane modules** 2) and a second plate (an outside plate 4a) equipped over each outlet end of the plurality of **humidifying units** are combined by a member 6 with insulation performance.

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IC ICM H01M008-04

ICS H01M008-10

L45 ANSWER 6 OF 9 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2001-216981 JAPIO

TITLE: HUMIDIFYING DEVICE FOR FUEL CELL

INVENTOR: SHIMANUKI HIROSHI; KUSANO YOSHIO; SUZUKI MIKIHIRO; KATAGIRI TOSHIKATSU

PATENT ASSIGNEE(S): HONDA MOTOR CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2001216981	A	20010810	Heisei	H01M008-04

#### APPLICATION INFORMATION

STN FORMAT: JP 2000-23220 20000131

ORIGINAL: JP2000023220 Heisei

PRIORITY APPLN. INFO.: JP 2000-23220 20000131  
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2001

AN 2001-216981 JAPIO

AB PROBLEM TO BE SOLVED: To maintain efficiency of a stack in a good condition while preventing decrease of the amount of moisture collected from an offgas passing through the stack.

SOLUTION: A **humidifying device** 21 is provided for **humidifying a supply gas**

supplied to the stack 3 while delivering moisture in offgas from the stack 3. The **humidifying** device 21 has a **humidifier** having plurality a of tubular hollow strings formed with moisture permeable films, provided in a cylindrical casing. A cooling water pipe 22 connected to the stack 3 is guided into a space along the outer periphery of the **humidifier** of the **humidifying** device 21, via which a cooling water heated by cooling the stack 3 is fed into a heated space portion. With the flow of the cooling water along the outer periphery of the **humidifier**, the **humidifier** is heated by the cooling water, while preventing the temperature drop of the offgas passing through the inside and preventing the decrease of a water collection amount due to the condensation of steam in the off-gas.

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IC ICM H01M008-04

ICS B60K001-04; H01M008-10

L45 ANSWER 7 OF 9 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 1997-027334 JAPIO

TITLE: SOLID POLYMER ELECTROLYTE FILM FUEL  
CELL AND MANUFACTURE THEREOF

INVENTOR: OKAMOTO TAKAFUMI; KATO HIDEO; KAWAGOE TAKAMASA;  
YAMAMOTO AKIO; TANAKA ICHIRO

PATENT ASSIGNEE(S): HONDA MOTOR CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 09027334	A	19970128	Heisei	H01M008-04

#### APPLICATION INFORMATION

STN FORMAT: JP 1995-173814 19950710

ORIGINAL: JP07173814 Heisei

PRIORITY APPLN. INFO.: JP 1995-173814 19950710

SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1997

AN 1997-027334 JAPIO

AB PROBLEM TO BE SOLVED: To keep a solid polymer electrolyte film wet and make re-starting quick by arranging an inlet and outlet for supplying and **exhausting** a **humidifying** **fluid** for the solid polymer electrolyte film in a fuel gas path or an oxidizing gas path, and connecting the inlet and outlet to a **humidifying** fluid supply source.

SOLUTION: When water is filled in each gas supply path of an anode plate 26 and a cathode plate 24 and that is detected with a detecting means, the energized state of a pump is stopped and stopped state is kept. A solid polymer electrolyte film 22

interposed between a first manifold plate 42 and a second manifold plate 50 keeps wet state together with the cathode plate 24 and the anode plate 26. When water is filled, a third opening/closing valve, a sixth opening/closing valve, a seventh opening/closing valve, and a ninth opening/ closing valve are closed. A fear that an operating gas remaining within a fuel cell cross leaks the electrolyte film and causes catalytic combustion is completely eliminated.

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IC ICM H01M008-04

ICS H01M008-02

L45 ANSWER 8 OF 9 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 1996-273687 JAPIO

TITLE: SUPPLY GAS  
HUMIDIFIER OF FUEL  
CELL

INVENTOR: FUJIKAWA FUTOSHI; HASEGAWA YASUAKI; WATANABE  
SHOGO

PATENT ASSIGNEE(S): MAZDA MOTOR CORP

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 08273687	A	19961018	Heisei	H01M008-04

#### APPLICATION INFORMATION

STN FORMAT: JP 1995-73864 19950330

ORIGINAL: JP07073864 Heisei

PRIORITY APPLN. INFO.: JP 1995-73864 19950330  
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1996

AN 1996-273687 JAPIO

AB PURPOSE: To provide a compact humidifier having high humidifying efficiency.

CONSTITUTION: An inside space of a jacket 12 sandwiched by a pair of partition plates 13 and 14 constitutes a water chamber 18, and an inlet 19 and an outlet 20 of water are formed in positions in close vicinity to the respective partition plates 13 and 14, and cooling water piping is connected, and fuel gas is introduced to an inside space of respective hollow thread films from the side of one partition plate 13 of a hollow thread film bundle 11 supported with a pair of partition plates 13 and 14 of the jacket 12. It flows toward the side of the other partition plate 14, and is guided to the other gas chamber 17, and on the other hand, cooling water is introduced to the inside space 18 of the jacket 12 from the inlet '19 arranged on the side of the partition plate 14 on the gas outlet side, and flows in the opposite

direction of the gas flowing direction while indirectly contacting with gas flowing inside of it from outside of the **hollow thread** films 1, and is discharged from the side of the partition plate 13 on the gas inlet side. The fuel gas is introduced so as to flow in the opposite direction of the cooling water in a **humidifier** 7, and is **humidified** by contacting with the cooling water through the **hollow thread** films.

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IC ICM H01M008-04  
ICS H01M008-10

L45 ANSWER 9 OF 9 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 1995-245116 JAPIO

TITLE: FUEL CELL

INVENTOR: ISHIMARU YOICHI; MIZUNO SEIJI

PATENT ASSIGNEE(S): TOYOTA MOTOR CORP

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 07245116	A	19950919	Heisei	H01M008-04

#### APPLICATION INFORMATION

STN FORMAT: JP 1994-64518 19940307

ORIGINAL: JP06064518 Heisei

PRIORITY APPLN. INFO.: JP 1994-64518 19940307

SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1995

AN 1995-245116 JAPIO

AB PURPOSE: To make a device compact by providing a **humidifier** in a stack.

CONSTITUTION: **Hollow thread** films 69 constituting oxygen gas supply piping 35 or hydrogen gas supply piping 45 are arranged in a cooling plate 51 arranged in a stack. In the **hollow thread** films 69, a film showing permeability to water is formed in a **hollow thread** shape, and the material is formed by bonding a support film to support a resin film to this porous resin film having a property of which water transmission speed is larger than gas transmission speed. In this constitution, **humidification** to oxygen **gas** and hydrogen **gas supplied** to respective cells can be performed in the stack by using an existing cooling water passage.

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IC ICM H01M008-04  
ICS H01M008-10

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L46 ANSWER 1 OF 8 JAPIO (C) 2004 JPO on STN  
 ACCESSION NUMBER: 2003-178781 JAPIO  
 TITLE: HUMIDIFIER FOR FUEL  
 CELL  
 INVENTOR: KATAGIRI TOSHIKATSU; SHIMANUKI HIROSHI; SUZUKI  
 MIKIHIRO; KUSANO YOSHIO  
 PATENT ASSIGNEE(S): HONDA MOTOR CO LTD  
 PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2003178781	A	20030627	Heisei	H01M008-04

#### APPLICATION INFORMATION

STN FORMAT: JP 2002-232089 20000119  
 ORIGINAL: JP2002232089 Heisei  
 PRIORITY APPLN. INFO.: JP 2002-232089 20000119  
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2003

AN 2003-178781 JAPIO

AB PROBLEM TO BE SOLVED: To provide a **humidifier** for a **fuel cell** equipped with a heating means by which the possessed heat of the cooling water of the **fuel cell** can be used effectively for heating of a hollow yarn membrane so that the moisture in the **hollow fiber** film may not freeze in a cold district and the like.

SOLUTION: The **humidifier** 2 for **fuel**

**cells** is constituted by accommodating a large number of water permeating hollow yarn membranes allotted along the length direction of a housing 31 in the above housing 31, and by performing moisture exchange between the above gases by making the gases, of which the moisture contents differ on the inside and outside of the hollow yarn films, respectively, pass through, to **humidify** the dry gas of lower moisture content. It has a heating means, which can supply quantity of heat to the hollow yarn membrane bunch 36 which has been bundled the hollow yarn membranes, and the cooling water (warm water) after cooling the **fuel cell** body is used as a source of heating the heating means.

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IC ICM H01M008-04

ICS B01D063-02; F24F006-00; F24F006-08; H01M008-10

L46 ANSWER 2 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2003-031245 JAPIO

TITLE: HUMIDIFYING SYSTEM FOR FUEL

**CELL**

**INVENTOR:** KATAGIRI TOSHIKATSU; SHIMANUKI HIROSHI; SUZUKI MIKIHIRO  
**PATENT ASSIGNEE(S):** HONDA MOTOR CO LTD  
**PATENT INFORMATION:**

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2003031245	A	20030131	Heisei	H01M008-04

**APPLICATION INFORMATION**

STN FORMAT: JP 2001-213806 20010713  
 ORIGINAL: JP2001213806 Heisei  
 PRIORITY APPLN. INFO.: JP 2001-213806 20010713  
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2003

AN 2003-031245 JAPIO

AB PROBLEM TO BE SOLVED: To provide a **humidifying** system for a **fuel cell** capable of maintaining and adjusting balance between a **humidifying** amount of fuel gas fed to the **fuel cell** and a **humidifying** amount of oxidizer gas fed to the **fuel cell** even when an output of the **fuel cell** becomes large.  
 SOLUTION: The **humidifying** system for the **fuel cell** is provided with a **fuel cell** 1 generating electricity by respectively feeding a fuel gas to an anode 1a and an oxidizer gas to a cathode 1c and causing a chemical reaction in the interior, a first **humidifier** ( **humidifier** 2 for the fuel gas) for moving moisture to the fuel gas from cathode offgas discharged from the cathode 1c of the **fuel cell** 1 via a **hollow fiber** membrane, and a second **humidifier** ( **humidifier** 3 for air) for moving moisture to the oxidizer gas from the cathode offgas having passed the first **humidifier** ( **humidifier** 2 for the fuel gas) via a **hollow fiber** membrane. A bypass passage 7 bypassing the first **humidifier** ( **humidifier** 2 for the fuel gas) is provided on a passage for the cathode offgas.

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IC ICM H01M008-04

ICS H01M008-10

L46 ANSWER 3 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2002-289228 JAPIO

TITLE: HUMIDIFIER AND ITS USE

INVENTOR: SAITO MASAHIRO; NAKAYAMA TOSHIHIRO

PATENT ASSIGNEE(S): NOK CORP

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002289228	A	20021004	Heisei	H01M008-04

**APPLICATION INFORMATION**

STN FORMAT: JP 2001-83325 20010322  
 ORIGINAL: JP2001083325 Heisei  
 PRIORITY APPLN. INFO.: JP 2001-83325 20010322  
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2002

AN 2002-289228 JAPIO

AB PROBLEM TO BE SOLVED: To provide a humidifier suitably used for feeding to a solid polymer fuel cell and excellent in quality.  
 SOLUTION: An imide material is used as a material for a hollow fiber membrane 2. The fiber membrane 2 is immersed into polyalcohol. After manufacturing the fiber membrane 2, heating history is imparted to the fiber membrane 2 before a potting part is formed.

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ICM H01M008-04

ICS B01D053-22; B01D063-02; B01D071-64; H01M008-06; H01M008-10

ICA F24F006-04

L46 ANSWER 4 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2002-075423 JAPIO

TITLE: HUMIDIFIER FOR FUEL CELL

INVENTOR: TONEGAWA SEIJI; SHIMANUKI HIROSHI; TSUCHIYA TOMOHIRO; NUMATA HIDEO

PATENT ASSIGNEE(S): HONDA MOTOR CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002075423	A	20020315	Heisei	H01M008-04

**APPLICATION INFORMATION**

STN FORMAT: JP 2000-265925 20000901  
 ORIGINAL: JP2000265925 Heisei  
 PRIORITY APPLN. INFO.: JP 2000-265925 20000901  
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2002

AN 2002-075423 JAPIO

AB PROBLEM TO BE SOLVED: To provide a humidifier for a fuel cell enabled to heighten a humidifying efficiency by making a water permeating

**humidifier** efficiently function, and heighten a collecting efficiency of the moisture contained in an exhaust gas.

**SOLUTION:** The **humidifier** 2 for the **fuel cell** comprises **hollow thread** membrane modules 21a, 21b connected serially with each other, making moisture contained in an exhaust air Ae of the **fuel cell** 1 permeate into the side of a supply air A supplied to the **fuel cell** 1, and a heat exchanger 22 located between the modules and heating the supply air A. The **humidifier** for the **fuel cell** comprises **hollow thread** membrane modules connected serially with each other, making moisture contained in an exhaust air of the **fuel cell** permeate into the side of a supply air supplied to the **fuel cell**, and a heat exchanger located between the modules and heating the supply air.

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IC ICM H01M008-04  
ICS B01D053-22; B01D063-02; F24F006-00; F24F006-04; H01M008-06

L46 ANSWER 5 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2002-075421 JAPIO

TITLE: HUMIDIFIER FOR FUEL  
CELL

INVENTOR: NUMATA HIDEO; KATAGIRI TOSHIKATSU; TSUCHIYA  
TOMOHIRO; TONEGAWA SEIJI

PATENT ASSIGNEE(S): HONDA MOTOR CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002075421	A	20020315	Heisei	H01M008-04

#### APPLICATION INFORMATION

STN FORMAT: JP 2000-264851 20000901

ORIGINAL: JP2000264851 Heisei

PRIORITY APPLN. INFO.: JP 2000-264851 20000901

SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2002

AN 2002-075421 JAPIO

AB PROBLEM TO BE SOLVED: To provide a **humidifier** for a **fuel cell** enabled to suitably use from the start of the **fuel cell** operation without separately installing a staring **humidifier**.

**SOLUTION:** A plurality of **hollow thread** membranes are housed in the housing 31 of a **hollow thread** membrane module 21 of the **humidifier**. A supply air A is made flow inside a housing and outside the **hollow thread** membrane. A cooling water W is made flow at a part of

the hollow thread membranes, and an exhaust air Ae exhausted from the fuel cell is made flow at another part of the hollow thread membranes. The supply air A is humidified due to the movement of the moisture contained in the exhaust air Ae into the supply air A. At the time that the moisture contained in the exhaust air Ae is not enough, like the starting time of the fuel cell, the supply air A is humidified by the cooling water W flowing at a part of the hollow thread membranes.

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IC ICM HO1M008-04

ICS B01D053-22; B01D063-02; F24F006-00; F24F006-04

L46 ANSWER 6 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2001-216982 JAPIO

TITLE: HUMIDIFYING SYSTEM FOR FUEL  
CELL

INVENTOR: SHIMANUKI HIROSHI; KUSANO YOSHIO; SUZUKI  
MIKIHIRO; KATAGIRI TOSHIKATSU

PATENT ASSIGNEE(S): HONDA MOTOR CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2001216982	A	20010810	Heisei	HO1M008-04

#### APPLICATION INFORMATION

STN FORMAT: JP 2000-23221 20000131

ORIGINAL: JP2000023221 Heisei

PRIORITY APPLN. INFO.: JP 2000-23221 20000131

SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2001

AN 2001-216982 JAPIO

AB PROBLEM TO BE SOLVED: To minimize the influence of short humidification on a stack by quickly detecting clogging in hollow strings constituting a humidifier.

SOLUTION: A humidifying device has the humidifier

having a plurality of tubular hollow strings formed with water-permeable films for allowing offgas fed out of the stack to pass through the hollow strings and a supply gas fed into the stack to pass between the hollow strings to deliver water in the offgas to the supply gas. Pressure gauges P1, P2, P3, P4 are provided at the upstream and downstream sides of the humidifying device for detecting the pressures of the supply gas and the offgas. Judging means 22 is provided for finding differential pressures of the supply gas and the offgas between the upstream and downstream sides via the humidifying device

in accordance with detection signals from the pressure gauges P1, P2, P3, P4 and detecting clogging in the hollow strings and between the hollow strings of the **humidifier** of the **humidifying device** from the differential pressures.

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IC ICM H01M008-04  
ICS H01M008-10

L46 ANSWER 7 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2001-202978 JAPIO

TITLE: **HUMIDIFIER**

INVENTOR: SHIMANUKI HIROSHI; KUSANO YOSHIO; SUZUKI MIKIHIRO; KATAGIRI TOSHIKATSU

PATENT ASSIGNEE(S): HONDA MOTOR CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2001202978	A	20010727	Heisei	H01M008-04

#### APPLICATION INFORMATION

STN FORMAT: JP 2000-10972 20000119  
ORIGINAL: JP2000010972 Heisei

PRIORITY APPLN. INFO.: JP 2000-10972 20000119  
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2001

AN 2001-202978 JAPIO

AB PROBLEM TO BE SOLVED: To improve water recovery rate, by enabling adequate moisture exchange, even at the end of a bulk **hollow fiber** membrane which is housed in a housing.

SOLUTION: In a **humidifier** for a **fuel cell**, a bulk **hollow fiber** membrane 21b, which is made by tying the water permeable **hollow fiber** membranes arranged along a longitudinal direction of a housing 21a in a bundle, is housed inside the housing 21a. Off-gas is fed inside the **hollow fiber** membrane, dry air is fed outside the follow fiber membrane to exchange moisture, and the dry air is **humidified**. At the center of the housing 21a, a by-pas pipe 21e for dry air is arranged, and the dry air flows in from the inlets 21fa, which are provided on the by-pass pipe 21e to feed inside the by-pass pipe 21e. The dry gas fed inside the by-pass pipe 21e is vented from the outlets 21fb.

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IC ICM H01M008-04  
ICS B01D053-22; F24F006-06; H01M008-10

L46 ANSWER 8 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2001-202977 JAPIO

TITLE: HUMIDIFIER  
 INVENTOR: KUSANO YOSHIO; SHIMANUKI HIROSHI; SUZUKI  
           MIKIHIRO; KATAGIRI TOSHIKATSU  
 PATENT ASSIGNEE(S): HONDA MOTOR CO LTD  
 PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2001202977	A	20010727	Heisei	H01M008-04

## APPLICATION INFORMATION

STN FORMAT: JP 2000-10971 20000119  
 ORIGINAL: JP2000010971 Heisei  
 PRIORITY APPLN. INFO.: JP 2000-10971 20000119  
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2001

AN 2001-202977 JAP10

AB PROBLEM TO BE SOLVED: To provide a **humidifier**, in which water permeability from a damp gas side to a dry gas side can be increased, and which can be used satisfactorily for **humidifying a fuel cell**.

SOLUTION: In the **humidifier**, a large number of water permeable **hollow fiber** membranes arranged along a longitudinal direction of a housing, are housed in a housing, a moisture exchange between gases is performed by feeding the gases having different moisture contents inside and outside of the **hollow fiber** membrane, respectively, and dry gas having low moisture content is **humidified**. On the inner **hollow fiber** membrane, a structure for generating turbulence is provided. ON the inner wall of the **hollow fiber** membrane, the projections are provided. At a gas inlet to the inside the **hollow fiber** membrane, a twisting fin is provided. At the gas inlet to the inside the **hollow fiber** membrane, a step is provided.

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IC ICM H01M008-04

ICS B01D063-02; F24F006-06; H01M008-10

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L42 ANSWER 1 OF 15 HCA COPYRIGHT 2004 ACS on STN  
 139:182070 Hollow-fiber membrane modules and  
 hollow-fiber membrane unit using same. Inamura,  
 Tamio (NOK Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2003236346 A2  
 20030826, 8 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP  
 2002-40257 20020218.

- AB In title app. including hollow-fiber membrane  
 modules having plural hollow-fiber membranes in  
 casings, and headers arranged at both ends of the hollow-  
 fiber membrane modules, resp., fastening components having  
 flange-like sections and bolts, etc., are arranged on the headers  
 and at the external circumferences for the casings for fixing both  
 end portions of the hollow-fiber membrane  
 modules in the headers, resp. The app. can be used for  
 humidification of partition walls (i.e., ion-exchange  
 membranes) of fuel cells, etc.
- IC ICM B01M063-02  
 ICS H01M008-04; H01M008-06
- CC 47-2 (Apparatus and Plant Equipment)  
 Section cross-reference(s): 52
- ST hollow fiber membrane unit; module  
 hollow fiber membrane; fuel cell  
 ion exchange membrane humidification hollow  
 fiber membrane; partition wall fuel cell  
 humidification hollow fiber membrane  
 unit
- IT Seals (parts)  
 (flanged; hollow-fiber membrane modules and  
 hollow-fiber membrane unit using same)
- IT Membranes, nonbiological  
 (hollow-fiber; hollow-fiber  
 membrane modules and hollow-fiber membrane  
 unit using same)
- IT Ion exchange membranes  
 (humidification of; hollow-fiber  
 membrane modules and hollow-fiber membrane  
 unit using same for)
- IT Fuel cells  
 (ion-exchange membranes of, humidification of;  
 hollow-fiber membrane modules and  
 hollow-fiber membrane unit using same for)

L42 ANSWER 2 OF 15 HCA COPYRIGHT 2004 ACS on STN  
 139:8515 Hollow-fiber membrane modules. Kuroki,  
 Yuichi; Nakayama, Tomoihiro; Namikata, Kazuhiko (NOK Corp., Japan).  
 Jpn. Kokai Tokkyo Koho JP 2003164735 A2 20030610, 6 pp. (Japanese).  
 CODEN: JKXXAF. APPLICATION: JP 2001-364517 20011129.

- AB The title modules are composed of a cylindrical case, hollow

-fiber membranes, potting parts for end fixing of the membranes, and fixers(e.g., pins) for the potting parts in the case. They are used for, e.g., humidification of gases for fuel cells.

- IC ICM B01D063-02  
ICS B01D063-00; H01M008-04; H01M008-10  
CC 47-2 (Apparatus and Plant Equipment)  
Section cross-reference(s): 52  
ST membrane hollow fiber module  
IT Membranes, nonbiological  
(hollow-fiber, modules; hollow-fiber membrane modules)

L42 ANSWER 3 OF 15 HCA COPYRIGHT 2004 ACS on STN  
138:388219 Hollow fiber membrane

humidification apparatus. Katagiri, Toshikatsu; Suzuki, Mikihiro; Katano, Takeshi (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2003157872 A2 20030530, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-356612 20011121.

AB The invention relates to structure of the app. for prevention of noise generated due to vibration of hollow fiber membranes. The app. is for humidification of electrolytes in fuel cells. The app. is quiet.

- IC ICM H01M008-04  
ICS B01D053-22; B01D063-02; H01M008-10  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 47  
ST noiseless hollow fiber membrane  
humidification app; fuel cell

IT electrolyte humidification app noiseless  
Humidity  
(controller; noiseless hollow fiber membrane  
humidification app. for use in fuel  
cells)

IT Membranes, nonbiological  
(hollow-fiber; noiseless hollow  
fiber membrane humidification app. for use in  
fuel cells)

IT Fuel cell electrolytes  
(noiseless hollow fiber membrane  
humidification app. for use in fuel  
cells)

L42 ANSWER 4 OF 15 HCA COPYRIGHT 2004 ACS on STN  
138:223403 Gas humidifier with hollow-fiber

membranes and gas humidification system using same..  
Katagiri, Toshikatsu; Suzuki, Mikihiro (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2003065566 A2 20030305, 11 pp.

(Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-254762 20010824.

AB In gas humidifier including hollow-fiber membranes, a casing for accommodating bundled hollow-fiber membranes, and gases having different moisture content supplied to the inner and outer sides of the hollow-fiber membranes, resp., for exchanging moisture between them, the following means are provided: a jacket having secondary side gas inlet and outlet for surrounding the casing, a seal arranged between the casing and the jacket for hindering gas flowing from the secondary side gas inlet to the secondary side gas outlet, and retention sections surrounded by the casing, the jacket and the seal. Gas humidification system including plural gas humidifiers is described. The gas humidifier and gas humidification system can be used in fuel cell system for humidification of air and H<sub>2</sub> gas by moisture-contg. unreacted air (air off-gas).

IC ICM F24F006-04

ICS B01D063-02; H01M008-04; H01M008-10

CC 47-5 (Apparatus and Plant Equipment)

Section cross-reference(s): 52

ST gas humidifier system hollow fiber membrane; fuel cell air hydrogen humidification gas humidifier system

IT Membranes, nonbiological  
(hollow-fiber; gas humidifier with  
hollow-fiber membranes and gas  
humidification system using same)

IT Fuel cells  
(humidification of air and hydrogen for; as  
humidifier with hollow-fiber  
membranes and gas humidification system using same for)

IT Air  
(humidification of, for fuel cells;  
gas humidifier with hollow-fiber  
membranes and gas humidification system using same)

IT Gases  
(humidification of; gas humidifier with  
hollow-fiber membranes and gas  
humidification system using same)

IT 1333-74-0, Hydrogen, processes  
(humidification of, for fuel cells;  
gas humidifier with hollow-fiber  
membranes and gas humidification system using same)

L42 ANSWER 5 OF 15 HCA COPYRIGHT 2004 ACS on STN  
138:156210 Humidifier for working medium gas of fuel  
cell system. Li, Xiangyi (Peop. Rep. China). Faming  
Zhanli Shengqing Gongkai Shuomingshu CN 1323073 A 20011121, 7 pp.

(Chinese). CODEN: CNXXEV. APPLICATION: CN 2001-114150 20010629.

AB The **humidifier** consists of a bundle of **hollow fibers**, a shell, gas inlet and outlet, water inlet and outlet, and seals. The **hollow fibers** are manufd. from super filtering films or anti-osmosis films of synthetic or natural high polymers or inorg. materials; the seals are binders of thermosetting high polymers, thermoplastic high polymers, or inorg. materials such as cement; and the shell is made from stainless steel, metals, industrial plastics, or ceramics.

IC ICM H01M008-04

ICS H01M008-02

CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST fuel cell working gas **humidifying** app

IT Cement

Ceramics

Fuel cells

(**humidifier** for working medium gas of **fuel cell system**)

IT Plastics, uses  
(**humidifier** for working medium gas of **fuel cell system**)

IT Air conditioners  
(**humidifiers**; **humidifier** for working medium gas of **fuel cell system**)

IT 12597-68-1, Stainless steel, uses  
(**humidifier** for working medium gas of **fuel cell system**)

L42 ANSWER 6 OF 15 HCA COPYRIGHT 2004 ACS on STN  
138:58180 Hollow-fiber membrane module.. Katagiri,  
Toshikatsu; Shimanuki, Hiroshi; Suzuki, Mikihiro (Honda Motor Co.,  
Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2002370017 A2 20021224, 16  
pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-178450  
20010613.

AB In title app. including a **hollow-fiber** membrane bundle formed from plural **hollow-fiber** membranes accommodated in a casing, and fluids contg. different moisture contents flowing at inner and outer sides of the **hollow-fiber** membranes for exchanging moisture, a flow path wall having plural holes is formed at the outer side of the **hollow-fiber** membranes, and the opening ratio of the plural holes are changed according to their distances from the inlets and/or outlets of the fluid flowing at the outer side of the **hollow-fiber** membranes, resp. The above stated inlets are formed at one end portion of the casing, and the outlets are formed at the other end portion of the casing. A part of the flow path wall is contacted with the inlets and/or outlets. The app. can be utilized as the **humidifier** for supplying air

- to fuel cells of elec. automobile.
- IC ICM B01D063-02  
ICS H01M008-04; H01M008-10
- CC 48-1 (Unit Operations and Processes)  
Section cross-reference(s): 52
- ST hollow fiber membrane module; fuel  
cell air supply humidifier hollow  
fiber membrane module
- IT Water vapor  
(adding of, of air; hollow-fiber membrane  
module utilized as humidifier for supplying air to  
fuel cells of elec. automobile)
- IT Electric vehicles  
(automobiles, fuel cells of; hollow  
-fiber membrane module utilized as humidifier  
for supplying air to fuel cells of elec.  
automobile)
- IT Automobiles  
(elec., fuel cells of; hollow-  
fiber membrane module utilized as humidifier  
for supplying air to fuel cells of elec.  
automobile)
- IT Membranes, nonbiological  
(hollow-fiber; hollow-fiber  
membrane module utilized as humidifier for supplying  
air to fuel cells of elec. automobile)
- IT Air  
(humidifier for; hollow-fiber  
membrane module utilized as humidifier for supplying  
air to fuel cells of elec. automobile)
- IT Fuel cells  
(of elec. automobile; hollow-fiber membrane  
module utilized as humidifier for supplying air to  
fuel cells of elec. automobile)
- L42 ANSWER 7 OF 15 HCA COPYRIGHT 2004 ACS on STN  
138:42098 Humidifying system for a fuel cell  
. Katajiri, Toshikatsu; Shimanuki, Hiroshi; Suzuki, Motohiro (Honda  
Giken Kogyo Kabushiki Kaisha, Japan). U.S. Pat. Appl. Publ. US  
2003008189 A1 20030109, 13 pp. (English). CODEN: USXXCO.  
APPLICATION: US 2002-190072 20020703. PRIORITY: JP 2001-204286  
20010705.
- AB A humidifying system for a fuel cell  
includes: a fuel cell having an anode and a  
cathode, the anode being supplied with a fuel gas and the cathode  
being supplied with an oxidant gas so that the fuel gas and the  
oxidant gas chem. react within the fuel cell to  
generate electricity; a first humidifier transferring

moisture of cathode exhaust gas discharged from the cathode of the fuel cell to the fuel gas through hollow fiber membranes; a second humidifier transferring moisture of cathode exhaust gas discharged from the first humidifier to the oxidant gas through hollow fiber membranes; and a reduced pressure generating device arranged downstream of the first humidifier and between the first humidifier and the fuel cell to mix part of anode exhaust gas discharged from the anode of the fuel cell with the fuel gas using neg. pressure resulting from a flow of the fuel gas.

- IC ICM H01M008-04  
 NCL 429026000; 429013000; 429025000  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 47  
 ST fuel cell humidifying system  
 IT Membranes, nonbiological  
     (hollow-fiber; humidifying system  
     for fuel cell)  
 IT Ejectors  
     Exhaust gases (engine)  
     Fuel gases  
     Solid state fuel cells  
     (humidifying system for fuel cell)  
 IT 7732-18-5, Water, uses  
     (humidification by; humidifying system for  
     fuel cell)

L42 ANSWER 8 OF 15 HCA COPYRIGHT 2004 ACS on STN  
 138:26902 Hollow fiber membrane module for  
 fuel cells. Katagiri, Toshikatsu; Shimanuki,  
 Hiroshi; Suzuki, Mikihiro (Honda Motor Co., Ltd., Japan). Jpn.  
 Kokai Tokkyo Koho JP 2002358988 A2 20021213, 10 pp. (Japanese).  
 CODEN: JKXXAF. APPLICATION: JP 2001-167343 20010601.

AB The membrane has a bundle of hollow fibers in a housing, for passing fluids of different water content inside and outside the membrane, resp., and means on the inside wall of the container causing the outside fluid to flow in a swirl form, with respect to the axis of the fibers along the length direction of the fibers. The module is useful as humidifier for an automobile fuel cell.

- IC ICM H01M008-04  
 ICS H01M008-04; B01D063-02; H01M008-10; H01M008-00  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST automobile fuel cell humidifier  
     hollow fiber membrane module  
 IT Membranes, nonbiological

(hollow-fiber; structure of hollow fiber membrane modules for fuel cell humidifiers for automobiles)

IT Fuel cells

Humidity

(structure of hollow fiber membrane modules for fuel cell humidifiers for automobiles)

L42 ANSWER 9 OF 15 HCA COPYRIGHT 2004 ACS on STN

137:297393 Humidifier module. Katagiri, Toshikatsu; Suzuki, Mikihiko; Shimanuki, Hiroshi; Kusano, Yoshio (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2002298883 A2 20021011, 8 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-99477 20010330.

AB The module has a hollow fiber membrane, for humidity exchange between 2 countercurrent flows flowing inside and outside the fibers, resp., surrounding an inner pipe passing the hotter flow, an inlet for the hotter flow at 1 end of the inner pipe and an outlet for the hotter flow to the outside of the fibers at the opposite end, inlet and outlet for the 2nd flow at the opposite ends of the hollow fiber membrane, and outlet for the hotter flow at 1 end of the hollow fiber membrane. The module is useful for humidifying fuel gas for polymer electrolyte fuel cells.

IC ICM H01M008-04

ICS F24F006-00; H01M008-10

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST polymer electrolyte fuel cell hollow fiber membrane humidifier

IT Fuel cells

Humidity

(structure of hollow fiber membrane humidifiers for polymer electrolyte fuel cells)

L42 ANSWER 10 OF 15 HCA COPYRIGHT 2004 ACS on STN

137:297392 Humidifier module. Katagiri, Toshikatsu; Kusano, Yoshio; Shimanuki, Hiroshi; Suzuki, Mikihiko (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2002298882 A2 20021011, 11 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-99476 20010330.

AB Humidifier module for a 1st hollow fiber bundle, for water exchange between 2 fluids flowing over the inside and outside of the fibers; a 2nd hollow fiber bundle surrounding the 1st bundle and parallel to the 1st bundle; an inlet at 1 end near the axis of the 1st bundle and an outlet at the opposite end of the 2nd bundle for passing a 1st fluid flowing outside the fibers; and sep. inlets and outlets on the 1st and 2nd bundles for passing a 2nd fluid, having a humidity different

from the 1st fluid, passing the inside of the fibers in a direction opposite to the 1st fluid. The module is useful for polymer electrolyte fuel cells.

- IC ICM H01M008-04  
 ICS F24F006-00; H01M008-10  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST polymer electrolyte fuel cell hollow fiber humidifier  
 IT Fuel cells  
 Humidity  
     (structure of hollow fiber  
     humidifiers for polymer electrolyte fuel cells)

L42 ANSWER 11 OF 15 HCA COPYRIGHT 2004 ACS on STN  
 136:234708 Apparatus for moisturization of fuel cell gases by treatment of fuel cell waste gases.

Tonegawa, Seiji; Shimanuki, Hiroshi; Tsuchiya, Tomohiro; Numata, Hideo (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2002075423 A2 20020315, 11 pp. (Japanese). CODEN: JKXXAF.

APPLICATION: JP 2000-265925 20000901.

- AB The app. works by permeation of the water in fuel cell waste gas through into the fuel gas. The water permeation-type moisturizers, e.g. hollow fiber membrane modules, are placed in series and are equipped with a means for heating of the fuel gas or the waste gas in between the moisturizers. Recovery rate of water from waste gas is improved.  
 IC ICM H01M008-04  
     ICS H01M008-04; B01D053-22; B01D063-02; F24F006-00; F24F006-04;  
     H01M008-06  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST water recovery fuel cell waste gas; moisturizer  
 fuel cell gas heater  
 IT Membranes, nonbiological  
     (hollow-fiber; water permeation-type  
     moisturizers for humidification of fuel  
     cell gases by treatment of fuel cell  
     waste gases)  
 IT Heating  
     (of gases; water permeation-type moisturizers for  
     humidification of fuel cell gases by  
     treatment of fuel cell waste gases)  
 IT Fuel cells  
 Waste gases  
     (water permeation-type moisturizers for humidification  
     of fuel cell gases by treatment of  
     fuel cell waste gases)

L42 ANSWER 12 OF 15 HCA COPYRIGHT 2004 ACS on STN  
 136:234707 Apparatus for moisturization of **fuel cell**  
 gases by treatment of **fuel cell** waste gases.

Suzuki, Mikihiro; Kusano, Yoshio; Shimanuki, Hiroshi; Tonegawa,  
 Seiji (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP  
 2002075422 A2 20020315, 9 pp. (Japanese). CODEN: JKXXAF.

APPLICATION: JP 2000-265692 20000901.

AB The app. works by permeation of the water in the **fuel**  
**cell** waste gas into the fuel gas, e.g. through a  
 water-permeating **hollow-fiber** membrane, under  
 control of the gas amt. in the waste gas side to be larger than that  
 in the fuel gas side. Further specified app. are also claimed.  
 Recovery rate of water from waste gas is improved.

IC ICM HO1M008-04  
 ICS HO1M008-04; B01D053-22; B01D063-02; F24F006-00; F24F006-04;  
 HO1M008-06

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST water recovery **fuel cell** waste gas; moisturizer  
**fuel cell** gas **hollow fiber**  
 membrane; humidifier **fuel cell** gas  
 water permeable membrane

IT Membranes, nonbiological  
 (hollow-fiber; moisturization of **fuel**  
**cell** gases by treatment of **fuel cell**  
 waste gas via water-permeable membranes under controlling gas  
 flow amts.)

IT **Fuel cells**  
 Waste gases  
 (moisturization of **fuel cell** gases by  
 treatment of **fuel cell** waste gas via  
 water-permeable membranes under controlling gas flow amts.)

L42 ANSWER 13 OF 15 HCA COPYRIGHT 2004 ACS on STN

135:125062 Humidifying systems for **fuel**  
**cells**. Kusano, Yoshio; Shimanuki, Hiroshi; Suzuki,  
 Mikihiro; Katagiri, Toshikatsu (Honda Motor Co., Ltd., Japan). Jpn.  
 Kokai Tokkyo Koho JP 2001216983 A2 20010810, 10 pp. (Japanese).  
 CODEN: JKXXAF. APPLICATION: JP 2000-23222 20000131.

AB The systems have a **humidifying** means, supplying moisture  
 from **fuel cell** off gases to reaction gases  
 supplied to the cells, attached to the cells; where the systems have  
**hollow fiber** bundles in a container with the off  
 (reaction) gas passing inside the fibers, and the reaction (off) gas  
 passing outside the fibers in the container.

IC ICM HO1M008-04  
 ICS B60K001-04; HO1M008-10  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST **fuel cell** **hollow fiber**

humidifying system

IT Fibers

(hollow; structure of hollow fiber  
humidifying systems for fuel cells)

IT Fuel cells

Humidity

(structure of hollow fiber  
humidifying systems for fuel cells)

L42 ANSWER 14 OF 15 HCA COPYRIGHT 2004 ACS on STN

135:125051 Fuel cell humidifying system.

Suzuki, Motohiro; Katagiri, Toshikatsu; Shimanuki, Hiroshi; Kusano, Yoshio (Honda Giken Kogyo Kabushiki Kaisha, Japan). U.S. Pat. Appl. Publ. US 20010010872 A1 20010802, 11 pp. (English). CODEN: USXXCO. APPLICATION: US 2001-774374 20010130. PRIORITY: JP 2000-23226 20000131.

AB The fuel cell humidifying system is to prevent freezing and clogging of a water permeable type humidifier by providing a gas passage switching device for changing the gas flow paths communicating with the humidifier. To direct the flow of dry air exiting from the supercharger to the exhaust passage in the humidifier, the gas passage switching device includes a first three-way valve, a second three-way valve, a flow adjusting valve and a sweep piping. In this system, water vapor in the humidifier which causes freezing can be swept off by flowing dry air through the exhaust gas passage in the humidifier, and therefore, clogging caused by ice particles which plug up the pores of the hollow thread membrane in the humidifier can be prevented.

IC ICM H01M008-02

ICS H01M008-10

NCL 429012000

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST fuel cell humidifying system; freezing

clogging prevention fuel cell

humidifying system

IT Fuel cells

(fuel cell humidifying system)

L42 ANSWER 15 OF 15 HCA COPYRIGHT 2004 ACS on STN

135:124995 Humidifier for fuel cells.

Katagiri, Toshikatsu; Shimanuki, Hiroshi; Suzuki, Mikihiro; Kusano, Yoshio (Honda Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001202979 A2 20010727, 11 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-10975 20000119.

AB In title app. including a membrane bundle having plural water-permeable hollow-fiber membranes arranged

in a casing along its longitudinal direction, flowing gases having different moisture contents at the inner and outer sides of the membranes for humidification of the dry gas having less moisture content by exchanging moisture between them, a heat-generating means (e.g., heater) is provided for supplying heat to the hollow-fiber membranes of the membrane bundle. The app. is suitable for fuel cells, e.g., solid polymer electrolyte fuel cells, even in cold district.

- IC ICM H01M008-04  
 ICS H01M008-04; B01D053-22; B01D063-02  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 47  
 ST humidifier hollow fiber membrane  
 fuel cell; solid state fuel cell  
 humidifier membrane  
 IT Fuel cells  
 Heaters  
 Solid state fuel cells  
 (hollow-fiber membrane humidifier  
 for fuel cells)  
 IT Membranes, nonbiological  
 (hollow-fiber, water-permeable;  
 hollow-fiber membrane humidifier for  
 fuel cells)  
 IT Air conditioners  
 (humidifiers; hollow-fiber membrane  
 humidifier for fuel cells)  
 IT Water vapor  
 (membrane permeation of; hollow-fiber  
 membrane humidifier for fuel cells)

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L44 ANSWER 1 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2004-085514 [09] WPIX  
 DNN N2004-068236 DNC C2004-035410  
 TI Humidifier for use in fuel cell for

car, has pair of gaps provided at perimeter of hollow fiber membrane bundle over wall surface of case.

DC J01 Q74 X16

PA (NIOD) NOK CORP

CYC 1

PI JP 2004006099 A 20040108 (200409)\* 20p H01M008-04

ADT JP 2004006099 A JP 2002-159601 20020531

PRAI JP 2002-159601 20020531

IC ICM H01M008-04

ICS B01D063-02; F24F006-08

AB JP2004006099 A UPAB: 20040205

NOVELTY - A **humidifier** (10) has a pair of gaps (S) provided at the perimeter of a **hollow fiber** membrane bundle (12) over the wall surface (11c) of a case (11), in vicinity of a transduction hole (11a) and an excretory pore (11b).

USE - Used in a **humidifier** of a **fuel**

cell used as a power generation system in a car.

ADVANTAGE - By providing gaps, the pressure loss is suppressed, and efficiency of the **humidifier** is improved.

DESCRIPTION OF DRAWING(S) - The figure shows a partial block diagram of the **humidifier**.

humidifier 10

case 11

transduction hole 11a

excretory pore 11b

wall surface 11c

**hollow fiber** membrane bundle 12

gap S

Dwg.2/11

FS CPI EPI GMPI

FA AB; GI

MC CPI: J01-C03

EPI: X16-C

L44 ANSWER 2 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2004-076873 [08] WPIX

DNN N2004-062107 DNC C2004-031956

TI **Humidification apparatus for fuel cell**

has buffer film to absorb impact of gas flowing from gas-inlet hole provided in housing accommodating **hollow fiber** membrane bundle.

DC J01 X16

PA (NIOD) NOK CORP

CYC 1

PI JP 2004006100 A 20040108 (200408)\* 18p H01M008-04

ADT JP 2004006100 A JP 2002-159602 20020531

PRAI JP 2002-159602 20020531

IC ICM H01M008-04

- AB ICS B01D063-02; B01D069-08  
 JP2004006100 A UPAB: 20040202
- NOVELTY** - A **humidification apparatus** (10) has a buffer film (14) which absorbs the impact of gas flowing from gas-inlet holes (11a) provided in the apparatus housing (11) accommodating an **hollow fiber** membrane bundle (12).
- USE - Used as a **humidification apparatus** for a **fuel cell** used for electric power generation.
- ADVANTAGE - Since the impact of gas on the **hollow fiber** membrane bundle is absorbed, breakage of the bundle is prevented.
- DESCRIPTION OF DRAWING(S) - The figure shows a sectional view of the **humidification apparatus**.
- humidification apparatus** 10  
 housing 11  
   gas-inlet holes 11a  
   gas-outlet holes 11b  
   **hollow fiber** membrane bundle 12  
 buffer film 14  
 Dwg. 2/10
- FS CPI EPI  
 FA AB; GI  
 MC CPI: J01-E03E  
 EPI: X16-C
- L44 ANSWER 3 OF 27 WPIX COPYRIGHT 2004 THOMSON DERMONT on STN  
 AN 2003-783632 [74] WPIX  
 DNC C2003-216223
- TI **Hollow fiber** membrane assembly for fluid processing apparatus, comprises potting ring mounted on periphery of potting material adhered to ends of fiber, to maintain bundles supported in alignment with each other.
- DC J01  
 PA (ASAG) ASAHI GLASS ENG KK  
 CYC 1  
 PI JP 2003236347 A 20030826 (200374)\* 7p B01D063-02  
 ADT JP 2003236347 A JP 2002-41797 20020219  
 PRAI JP 2002-41797 20020219  
 IC ICM B01D063-02  
   ICS B01D063-00  
 AB JP2003236347 A UPAB: 20031117
- NOVELTY** - A perforated support (15) supports **hollow fiber** membrane bundles (14) in alignment with each other by inserting the end of the bundles into respective support holes (20). A potting ring (17) is mounted on the periphery of a potting material adhered to the end of the bundles supported by the support.
- DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for **hollow fiber** membrane assembly manufacture.

**USE** - Used for a fluid processing apparatus, solid polymer fuel cells, dehumidifiers, humidifiers, concentrators, separators and filters.

**ADVANTAGE** - Disorder in the arrangement of hollow fiber membranes is prevented, and strength of the potting material is improved.

**DESCRIPTION OF DRAWING(S)** - The figure shows a sectional view of the fluid processing apparatus with a hollow fiber membrane assembly.

Hollow fiber membrane assembly 2A

Hollow fiber membrane bundle 14

Supports 15

Supporting material 16

Potting ring 17

Support hole 20

Dwg.1/7

FS CPI

FA AB; GI

MC CPI: J01-C03

L44 ANSWER 4 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
AN 2003-734472 [70] WPIX

DNN N2003-587254 DNC C2003-202426

TI Humidifier, for fuel cell, includes heat exchanger between serially connected hollow thread membrane modules, to heat air humidified by membrane modules.

DC J01 J02 Q74 X16

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2002075423 A 20020315 (200370)\* 1lp H01M008-04

ADT JP 2002075423 A JP 2000-265925 20000901

PRAI JP 2000-265925 20000901

IC ICM H01M008-04

ICS B01D053-22; B01D063-02; F24F006-00; F24F006-04; H01M008-06

AB JP2002075423 A UPAB: 20031030

**NOVELTY** - The humidifier has a pair of serially connected hollow thread membrane modules (21a,21b) to humidify the air supplied to a fuel cell (1) by the moisture content in the exhaust gas. A heat exchanger (22) between the hollow thread membrane modules heats the humidified air. The heated air is supplied to the fuel cell.

**USE** - For fuel cell.

**ADVANTAGE** - The air supplied to fuel cell is efficiently humidified, by the thread membranes.

**DESCRIPTION OF DRAWING(S)** - The figure shows the above humidifier. (Drawing includes non-English language text).

**fuel cell 1**  
**humidifier 2**  
 hollow thread membrane modules 21a,21b  
 heat exchanger 22

Dwg.1/1

FS CPI EPI GMPI  
 FA AB; GI  
 MC CPI: J02-A02  
 EPI: X16-C15

L44 ANSWER 5 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2003-734471 [70] WPIX

DNN N2003-587253 DNC C2003-202425

TI **Humidifier**, for **fuel cell**, includes  
 hollow thread membranes, from which  
 humidified air is supplied to **fuel cell**  
 simultaneously.

DC J02 Q74 X16

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2002075422 A 20020315 (200370)\* 9p H01M008-04

ADT JP 2002075422 A JP 2000-265692 20000901

PRAI JP 2000-265692 20000901

IC ICM H01M008-04

ICS B01D053-22; B01D063-02; F24F006-00; F24F006-04; H01M008-06  
 AB JP2002075422 A UPAB: 20031030

NOVELTY - The air exhausted from **fuel cell** (1)  
 is transduced into the **hollow thread** membranes  
 (21a,21b) of the **humidifier**, sequentially. The  
 humidified air is supplied back to the **fuel**  
 cell, from both the **hollow thread**  
 membranes, simultaneously.

USE - For **fuel cell**.

ADVANTAGE - The air exhausted from **fuel cell**  
 is humidified efficiently, by the specially designed  
 structure of the novel **humidifier**.

DESCRIPTION OF DRAWING(S) - The figure shows the structure of  
 the above **humidifier**. (Drawing includes non-English  
 language text).

**fuel cell 1**

hollow thread membranes 21a,21b

Dwg.1/1

FS CPI EPI GMPI  
 FA AB; GI  
 MC CPI: J02-A02  
 EPI: X16-C15

L44 ANSWER 6 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-537023 [51] WPIX  
 DNN N2003-426238 DNC C2003-145782  
 TI Hollow fiber membrane module for  
     humidifying feed-gas of fuel cell,  
     comprises case whose annular grooves enable fixing thermosetting  
     material which fixes hollow fiber membranes to  
     edges of case, within case.  
 DC J01 X16  
 PA (NIOD) NOK CORP  
 CYC 1  
 PI JP 2003164735 A 20030610 (200351)\* 6p B01D063-02  
 ADT JP 2003164735 A JP 2001-364517 20011129  
 PRAI JP 2001-364517 20011129  
 IC ICM B01D063-02  
     ICS B01D063-00; H01M008-04  
 ICA H01M008-10  
 AB JP2003164735 A UPAB: 20030808  
     NOVELTY - A module (1) has a cylindrical case (2) in which a number  
     of hollow fiber membranes (3) are arranged. The  
     hollow fiber membranes are fixed at the edges of  
     the case by a thermosetting material (4). Annular grooves (2a)  
     formed at inner face of the case, enable fixing the thermosetting  
     material in specified position within the case.  
     USE - Used for humidifying feed-gas of a fuel  
     cell.  
     ADVANTAGE - The shifting of the position of the thermosetting  
     material, due to the pressure of the gas supplied into the module,  
     can be prevented by firmly fixing the thermosetting material within  
     the case, even when the module is exposed to different conditions of  
     temperature and humidity.  
     DESCRIPTION OF DRAWING(S) - The drawing shows the schematic  
     view of the hollow fiber membrane module.  
 Module 1  
     Cylindrical case 2  
     Annular grooves 2a  
     Hollow fiber membranes 3  
     Thermosetting material 4  
 Dwg.1/6  
 FS CPI EPI  
 FA AB; GI  
 MC CPI: J01-C03  
     EPI: X16-C15  
 L44 ANSWER 7 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2003-475170 [45] WPIX  
 DNN N2003-378269  
 TI Humidification apparatus for fuel cell  
     used in vehicle, has hollow fibers accommodated

in between fluids comprising high and low moisture-contents.

DC X16  
PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2003157872 A 20030530 (200345)\* 6p H01M008-04

ADT JP 2003157872 A JP 2001-356612 20011121

PRAI JP 2001-356612 20011121

IC ICM H01M008-04

ICS B01D053-22; B01D063-02; H01M008-10

AB JP2003157872 A UPAB: 20030716

**NOVELTY** - The apparatus (1) includes a housing (2) provided with hollow fibers accommodated in between fluids comprising high and low moisture-contents, respectively. The housing includes an inner pipe (3) comprising an insert hole (16) and exit hole (15) through which the fluids are circulated.

**USE - Humidification apparatus for fuel cell** used in electric vehicle.

**ADVANTAGE** - Suppresses the vibration of the hollow fibers, thereby preventing the generation of noise. Hence, prevents the damage of the hollow fibers and improves the reliability and electric power generation of the fuel cell.

**DESCRIPTION OF DRAWING(S)** - The figure shows a cross-sectional view of the humidification apparatus for fuel cell. (Drawing includes non-English language text).

humidification apparatus 1

housing 2

inner pipe 3

exit hole 15

insert hole 16

Dwg.1/5

FS EPI

FA AB; GI

MC EPI: X16-C01; X16-C09

L44 ANSWER 8 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-282597 [28] WPIX

DNN N2003-224594 DNC C2003-074061

TI Hollow fiber membrane module, for electrically-powered vehicle, has holes in flow-path walls formed in outer side of hollow fiber membrane, whose opening ratio is altered based on distance between inlet and outlet of flow-paths.

DC J01 X16 X21

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2002370017 A 20021224 (200328)\* 16p B01D063-02

ADT JP 2002370017 A JP 2001-178450 20010613

PRAI JP 2001-178450 20010613

IC ICM B01D063-02

ICS H01M008-04

ICA H01M008-10

AB JP2002370017 A UPAB: 20030501

NOVELTY - A pair of flow-path walls (35,36) with holes are in the outer side of a **hollow fiber** membrane (32a) in a housing (31). The opening ratio of the holes is altered, according to the distance between the inlet and outlet of the flow-paths.

USE - For **humidification apparatus of fuel cell** in electrically-powered vehicle.

ADVANTAGE - Altering the opening ratio, and enables reduction in pressure loss in the housing. Since the fluid spreads round the whole of **hollow fiber** membrane, the **humidification efficiency** is improved.

DESCRIPTION OF DRAWING(S) - The figure shows the external and sectional views of the above **hollow fiber** membrane module. (Drawing includes non-English language text). Housing 31

**Hollow fiber** membrane 32a  
Flow-path walls 35,36

Dwg.4/16

FS CPI EPI

FA AB; GI

MC CPI: J01-C03

EPI: X16-C09; X21-A01F; X21-B01A

L44 ANSWER 9 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
AN 2003-282440 [28] WPIX

DNN N2003-224449 DNC C2003-074016

TI **Hollow fiber** membrane module, for electrically-powered vehicle, includes spiral flow path wall centering on **hollow fiber** membrane bundle along longitudinal direction with respect to flow of liquid flowing to outside of membranes.

DC J01 X16 X21

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2002358988 A 20021213 (200328)\* 10p H01M008-04

ADT JP 2002358988 A JP 2001-167343 20010601

PRAI JP 2001-167343 20010601

IC ICM H01M008-04

ICS B01D063-02; H01M008-10

ICA H01M008-00

AB JP2002358988 A UPAB: 20030501

NOVELTY - A housing (31) contains a **hollow fiber** membrane bundle (32) formed by bundling several **hollow fiber** membranes (32a). A spiral flow path wall (50) is in

the housing centering on the hollow fiber membrane bundle the longitudinal direction with respect to the flow of fluid which flows to the outer side of the hollow fiber membranes.

USE - E.g. for humidification apparatus, for fuel cell in electrically-powered vehicle.

ADVANTAGE - The amount of the fluid flowed to the outer side of the hollow fiber membrane is distributed uniformly, thus improving humidification property.

DESCRIPTION OF DRAWING(S) - The figure shows perspective and sectional views of the above hollow fiber membrane module. (Drawing includes non-English language text).

Housing 31

Hollow fiber membrane module 32

Hollow fiber membranes 32a

Spiral flow path wall 50

Dwg.4a,b/7

FS CPI EPI

FA AB; GI

MC CPI: J01-C03

EPI: X16-C09; X21-A01F; X21-B01A

L44 ANSWER 10 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
AN 2003-261797 [26] WPIX

DNN N2003-207685

TI Gas humidifier for fuel cells, uses seal ring fixed between housing which stores hollow fiber membrane and surrounding jacket, to prevent circulation of gas and form stay spaces around housing..

DC Q74 X16 X21

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2003065566 A 20030305 (200326)\* 11p F24F006-04  
ADT JP 2003065566 A JP 2001-254762 20010824

PRAI JP 2001-254762 20010824

IC ICM F24F006-04

ICS B01D063-02; H01M008-04; H01M008-10

AB JP2003065566 A UPAB: 20030428

NOVELTY - The humidifier (1) has a housing (2) which stores a hollow fiber membrane bundle. A jacket (3) having an inlet (17) and an outlet (18) for a gas, surrounds the housing. A seal ring (10a) fixed between the periphery of the housing and the jackets, prevents the circulation of the gas from the inlet to the outlet and divides two gas stay spaces (20a,20b) around the housing.

DETAILED DESCRIPTION - The moisture content is exchanged between two gases whose moisture contents differ when passing the gases respectively among the inner and outer sides of the

**hollow fiber membrane.**

An INDEPENDENT CLAIM is also included for gas humidification system.

USE - For performing humidification function in fuel cells mounted on fuel cell electric vehicle.

ADVANTAGE - The temperature reduction of the gas passed in a gas humidifier, can be decreased and the humidification function can be improved, since a gas which piles up in the gas stay spaces formed between the periphery of housing containing the hollow fiber membrane and a jacket surrounding the housing functions as a heat retention layer and suppresses the heat release to the external from the gas flowing in the humidifier. A separate fluid need not be necessarily used only for heat retention. The sealing can be made effectively with a simple structure, by providing a seal ring between the housing and the jacket to prevent a circulation of the gas between the inlet and outlet of the jacket. The seal structure becomes easy, since it is not necessary to seal between the gases passed inside and outside the hollow fiber membrane.

DESCRIPTION OF DRAWING(S) - The figure shows a sectional view of the gas humidifier. (Drawing includes non-English language text).

humidifier 1

housing 2

jacket 3

seal ring 10a

inlet 17

outlet 18

gas stay spaces 20a,20b

Dwg.1/5

FS EPI GMPI

FA AB; GI

MC EPI: X16-C01; X16-C09; X21-B01

L44 ANSWER 11 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-081939 [08] WPIX

DNN N2003-064283

TI Humidification module for humidifying fluid,  
uses membranes set around internal pipe to exchange water between  
warm fluid fed from internal pipe and other fluid fed from outside.

DC Q74 X16 X21

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2002298883 A 20021011 (200308)\* 8p H01M008-04

ADT JP 2002298883 A JP 2001-99477 20010330

PRAI JP 2001-99477 20010330

IC ICM H01M008-04

ICS F24F006-00; H01M008-10

AB JP2002298883 A UPAB: 20030204

NOVELTY - The **humidification** module (12) has several **hollow fiber** membranes (P) set around an internal pipe (16) which has a flow path to pass warm fluid fed from an inlet of one end into the membranes from an outlet (27) to exchange the water between the warm fluid and another fluid fed from an inlet (23) of one end to an outlet of the other end outside the internal pipe.

USE - For **humidifying** fluid of low humidity by promoting exchange of water content between two fluids in fluid cell system, etc.

ADVANTAGE - The heat calories contained in warm fluid which is at a relatively high temperature between two fluids can be retained and utilized effectively, since the warm fluid is fed from the interior of internal pipe into several **hollow fiber** membranes set around the internal pipe while the other fluid is passed through the membranes from outside the internal pipe. The **humidification** efficiency can be improved, since **humidification** module can be maintained at high temperature. The electricity generation efficiency can be improved, when applying to **fuel cell** system.

DESCRIPTION OF DRAWING(S) - The figure shows a perspective view of the **humidification** module.

Humidification module 12

Internal pipe 16

Inlet 23

Outlet 27

Hollow fiber membranes P

Dwg.2/7

FS EPI GMPI

FA AB; GI

MC EPI: X16-C01; X16-C09; X16-C15; X21-A01F; X21-B01A

L44 ANSWER 12 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-071756 [07] WPIX

DNN N2003-055989 DNC C2003-018791

TI Hollow fiber membrane **humidifier** for **fuel cell**, has fluid outlet holes formed on one side of **hollow fiber** membrane, whose diameter is less than inlet holes formed on another side.

DC J01 Q74 X16

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2002298895 A 20021011 (200307)\* 11p H01M008-06

ADT JP 2002298895 A JP 2001-101416 20010330

PRAI JP 2001-101416 20010330

IC ICM H01M008-06  
 ICS B01D063-02; F24F006-00; F24F006-04; H01M008-04; H01M008-10  
 AB JP2002298895 A UPAB: 20030129  
 NOVELTY - The diameter of an outlet hole (S2) formed on one side of the circumference of a hollow fiber membrane (HF), through which the fluid is sent out of the housing, is less than the inlet hole (S1) formed on another side of the circumference of the membrane.

USE - In a fuel cell.

ADVANTAGE - The spreading of fluid around the whole film of the hollow fiber membrane is enabled, improving the humidification efficiency.

DESCRIPTION OF DRAWING(S) - The figure shows a perspective view of the hollow fiber membrane module. (Drawing includes non-English language text).

Hollow fiber membrane (HF)

Inlet hole S1

Outlet hole S2

Dwg.1/9

FS CPI EPI GMPI

FA AB; GI

MC CPI: J01-C03

EPI: X16-C09; X16-C16

L44 ANSWER 13 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2003-064256 [06] WPIX  
 DNN N2003-050067 DNC C2003-016738

TI Humidification membrane module, for fuel cell, has cylindrical partition layer to enable fluid recirculation within housing.

DC J01 Q74 X16 X21

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2002303435 A 20021018 (200306)\* 15p F24F006-04

ADT JP 2002303435 A JP 2001-101814 20010330

PRAI JP 2001-101814 20010330

IC ICM F24F006-04

ICS B01D053-22; B01D063-02

ICA H01M008-04; H01M008-10

AB JP2002303435 A UPAB: 20030124

NOVELTY - The multi-layered hollow fiber membrane (12) held inside a housing (11) contacts fluids on its inner and outer layers (12a,12b). A prescribed length of cylindrical partition layer (17) is integral with the membrane, for dividing it into two portions and to enable fluid recirculation within the housing.

USE - For exchanging moisture content between gases, such as in a fuel cell used as power source for electric

vehicle, etc.

ADVANTAGE - Heat loss on membrane surface is reduced and channeling is reduced or prevented by using a partition layer which separates the fiber membrane, to enable fluid recirculation easily.

DESCRIPTION OF DRAWING(S) - The figure shows the above **humidification** membrane module. (Drawing includes non-English language text).

Housing 11

Multi-layered hollow fiber membrane 12

Inner layer 12a

Outer layer 12b

Cylindrical partition layer 17

Dwg.2/11

FS CPI EPI GMPI

FA AB; GI

MC CPI: J01-E01; J01-E03E

EPI: X16-C16; X21-A01F; X21-B01A

L44 ANSWER 14 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2002-457395 [49] WPIX

DNN N2002-360669 DNC C2002-130373

TI Humidification apparatus for fuel cell

, has hollow fiber membrane through which air to be humidified and cooling water are made to flow.

DC J01 Q74 X16 X21

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2002075421 A 20020315 (200249)\* 10p H01M008-04

ADT JP 2002075421 A JP 2000-264851 20000901

PRAI JP 2000-264851 20000901

IC ICM H01M008-04

ICS B01D053-22; B01D063-02; F24F006-00; F24F006-04

AB JP2002075421 A UPAB: 20020802

NOVELTY - Air to be humidified and cooling water flow through hollow fiber membranes (21). Air containing moisture ejected from a fuel cell also flows through the membranes in the opposite direction, such that the moisture of ejected air is imparted to the supply air. During start-up, supply air is humidified by the water.

USE - For fuel cells in electric vehicles.

ADVANTAGE - Separate **humidification** apparatus do not need to be provided at the time of start-up, since cooling water is used suitably, thus reducing size. While **humidification** property of a **humidifies** improves, the amount of water recovered also increases. Supply air is efficiently humidified over the whole of hollow fiber membrane.

DESCRIPTION OF DRAWING(S) - The figure shows a perspective view

and a sectional side view of the hollow fiber membrane module contained in a humidifier. (Drawing includes non-English language text).

#### Hollow fiber membrane 21

Dwg.4/7

FS CPI EPI GMPI

FA AB; GI

MC CPI: J01-E02C; J01-E03E  
EPI: X16-C; X16-C15; X21-B01A

L44 ANSWER 15 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2002-429944 [46] WPIX

DNN N2002-337944 DNC C2002-122378

TI Hollow fiber membrane module for humidification apparatus of fuel cell, has baffles arranged along a supply path at regular intervals.

DC J01 X16 X21

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2002066263 A 20020305 (200246)\* llp B01D063-02

ADT JP 2002066263 A JP 2000-258868 20000829

PRAI JP 2000-258868 20000829

IC ICM B01D063-02

ICS H01M008-04; H01M008-06

AB JP2002066263 A UPAB: 20020722

NOVELTY - Baffles (41a-41d) are provided to divide an air supply path (A) of a hollow fiber membrane module (21) which is arranged inside a housing (31).

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for the production of a hollow fiber membrane module.

USE - For a humidification apparatus of a fuel cell in an electric vehicle.

ADVANTAGE - The flow path of gas in a housing is lengthened and the flow rate of the gas is increased. Water content exchange is performed efficiently.

DESCRIPTION OF DRAWING(S) - The figure shows a perspective view and a cross-sectional side view of the hollow fiber membrane module. (Drawing includes non-English language text).

#### Hollow fiber membrane module 21

Housing 31

Baffles 41a-41d

Supply path A

Dwg.4.a,b/12

FS CPI EPI

FA AB; GI

MC CPI: J01-E02C  
EPI: X16-C09; X21-A01F; X21-B01A

L44 ANSWER 16 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2002-429943 [46] WPIX  
 DNN N2002-337943 DNC C2002-122377  
 TI **Hollow fiber membrane-type humidifier**  
 for fuel cell system of electric vehicle, has  
 inflow and outflow hole connection groove formed at internal  
 circumference surface of housing.  
 DC J01 Q13 Q74 X16 X21  
 PA (HOND) HONDA MOTOR CO LTD  
 CYC 1  
 PI JP 2002066262 A 20020305 (200246)\* 7p B01D063-02  
 ADT JP 2002066262 A JP 2000-258774 20000829  
 PRAI JP 2000-258774 20000829  
 IC ICM B01D063-02  
 ICS B60K001-04; F24F006-04  
 ICA H01M008-04; H01M008-10  
 AB JP2002066262 A UPAB: 20020722  
 NOVELTY - Several gas inlet holes (2A) and outlet holes (2B) are  
 formed at the end portions of a **hollow fiber**  
 membrane module (3). An inflow hole connection groove and outflow  
 hole connection grooves are formed at the internal circumference  
 surface of the housing (2), which are connected to the gas inlet  
 holes and gas outlet holes, respectively.  
 USE - For fuel cell systems, e.g. proton  
 exchange membrane fuel cells of electric  
 vehicles.  
 ADVANTAGE - Reduction of **humidification** capability is  
 prevented by providing the inflow and outflow hole connection  
 groove.  
 DESCRIPTION OF DRAWING(S) - The figure shows a sectional view  
 of the **hollow fiber** membrane-type  
**humidifier**.  
 Housing 2  
 Gas inlet holes 2A  
 Gas outlet holes 2B  
 Hollow fiber membrane module 3  
 Dwg.2/8  
 FS CPI EPI GMPI  
 FA AB; GI  
 MC CPI: J01-E02C  
 EPI: X16-C01C; X16-C09; X21-A01F; X21-B01A  
 L44 ANSWER 17 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2002-420726 [45] WPIX  
 DNN N2002-330944 DNC C2002-119528  
 TI **Humidification apparatus for fuel cell**,  
 , has housing with multiple hollow fiber

membranes whose initial hole is smaller than final hole.

DC J01 Q74 X16  
 PA (HOND) HONDA MOTOR CO LTD  
 CYC 1  
 PI JP 2002066265 A 20020305 (200245)\* 15p B01D063-02  
 ADT JP 2002066265 A JP 2000-264705 20000831  
 PRAI JP 2000-264705 20000831  
 IC ICM B01D063-02  
 ICS F24F006-00; F24F006-04  
 ICA H01M008-04  
 AB JP2002066265 A UPAB: 20020717  
 NOVELTY - A housing (20a) has multiple **hollow fiber** membranes (25) with several holes for water exchange between several gases. An initial hole near a gas inlet is smaller than a final hole.  
 USE - For use in a **fuel cell**.  
 ADVANTAGE - High efficiency is obtained as the gas is equally distributed through the holes.  
 DESCRIPTION OF DRAWING(S) - The figure shows a block diagram of the **humidification** apparatus. (Drawing includes non-English language text).  
 Housing 20a  
 Hollow fiber membranes 25  
 Dwg.6/12

FS CPI EPI GMPI  
 FA AB; GI  
 MC CPI: J01-E02C  
 EPI: X16-C09

L44 ANSWER 18 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2002-410684 [44] WPIX  
 DNN N2002-322870  
 TI **Humidification apparatus for fuel cell**, has plastic component provided between outer side plates provided over inlet and outlet ends of **hollow fiber** membrane.

DC X16  
 PA (HOND) HONDA MOTOR CO LTD  
 CYC 1  
 PI JP 2002075419 A 20020315 (200244)\* 7p H01M008-04  
 ADT JP 2002075419 A JP 2000-264704 20000831  
 PRAI JP 2000-264704 20000831  
 IC ICM H01M008-04  
 ICS H01M008-10  
 AB JP2002075419 A UPAB: 20020711  
 NOVELTY - The outer side plates (3a,4a) are respectively provided over inlet end and outlet end of a **hollow fiber** membrane (2). A plastic component (6) is provided between the outer

side plates.

USE - For fuel cell.

ADVANTAGE - Insulation between the **fuel cell** and the pressure control valve structures is ensured by providing plastic component between outer side plates. Liquid junction formation is prevented.

DESCRIPTION OF DRAWING(S) - The figure explains the flow of gas into the **hollow fiber** membrane of the **humidification** apparatus. (Drawing includes Non-English language text).

**Hollow fiber** membrane 2

Outer side plates 3a,4a

Plastic component 6

Dwg.2/7

FS EPI

FA AB; GI

MC EPI: X16-C01; X16-C09

L44 ANSWER 19 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2002-033630 [04] WPIX  
 DNN N2002-025875

TI Fuel cell system has auxiliary humidifier for supplying collected water to fuel cell, when humidification obtained by water-permeable-type humidifier is insufficient.

DC Q74 X16

IN KANAI, Y; KOBAYASHI, T; KUROSAKI, K; OKAMOTO, H; SHIMANUKI, H  
 PA (HOND) HONDA GIKEN KOGYO KK; (HOND) HONDA MOTOR CO LTD

CYC 4

PI US 2001021468 A1 20010913 (200204)\* 37p H01M008-04  
 CA 2339508 A1 20010908 (200204) EN H01M008-04  
 JP 2001256989 A 20010921 (200204) 12p H01M008-04  
 JP 2001351660 A 20011221 (200206) 8p H01M008-04  
 DE 10110419 A1 20031023 (200377) H01M008-02  
 US 6696192 B2 20040224 (200415) H01M002-00

ADT US 2001021468 A1 US 2001-801312 20010307; CA 2339508 A1 CA  
 2001-2339508 20010307; JP 2001256989 A JP 2000-64021 20000308; JP  
 2001351660 A JP 2000-171173 20000607; DE 10110419 A1 DE  
 2001-10110419 20010305; US 6696192 B2 US 2001-801312 20010307

PRAI JP 2000-171173 20000607; JP 2000-64021 20000308

IC ICM H01M002-00; H01M008-02; H01M008-04  
 ICS F24F006-00; F24F006-04; F24F011-02; H01M002-02; H01M008-00;  
 H01M008-06; H01M008-09; H01M008-10; H01M008-12

AB US2001021468 A UPAB: 20020117  
 NOVELTY - An auxiliary **humidifier** has a vapor/liquid separator (3) for separating water from exhaust gas exhausted from a **fuel cell** (1). An injector (17) injects water stored in a collected water storage tank (4) to the **fuel**

cell, when the amount of humidification obtained by a water-permeable-type humidifier (2), is insufficient for humidifying the cell.

**USE - Fuel cell system.**

**ADVANTAGE -** Power generation is started early, as the auxiliary humidifier carries out humidification when water-permeable-type humidifier is not able to carry out humidification when the fuel cell starts operating with a dry hollow fiber membrane. Sufficient humidification is achieved without wasteful power consumption. Power generating efficiency is increased.

**DESCRIPTION OF DRAWING(S) -** The figure shows the fuel cell system.

**Fuel cell 1**

Water-permeable-type humidifier 2

Vapor/liquid separator 3

Collected water storage tank 4

Injector 17

Dwg.1/28

FS EPI GMPI

FA AB; GI

MC EPI: X16-C09

L44 ANSWER 20 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
AN 2001-600046 [68] WPIX

DNN N2001-447640 DNC C2001-177622

TI Humidifier for fuel cell used in electric vehicle, allows moist gas and dry gas to flow orthogonally to the inner and outer surfaces of several hollow fiber membranes.

DC H08 J01 L03 Q74 X16 X21

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2001201122 A 20010727 (200168)\* 16p F24F006-04

ADT JP 2001201122 A JP 2000-10974 20000119

PRAI JP 2000-10974 20000119

IC ICM F24F006-04

ICS B01D053-22; B01D063-02; B01D069-08; F24F006-00

ICA H01M008-04

AB JP2001201122 A UPAB: 20011121

**NOVELTY -** The moist gas and dry gas are allowed to flow orthogonally to the inner surface and outer surface of several hollow fiber membranes arranged inside a housing along longitudinal direction. The moisture content between the gases is exchanged.

**USE -** For humidifying dry gas ejected from fuel cell used in electric vehicle.

**ADVANTAGE -** Performs the exchange of moisture content between the gases by flowing the moist gas and dry gas along orthogonal

direction. Recovers the water efficiently.

DESCRIPTION OF DRAWING(S) - The figure shows a sectional view of **humidifier**.

Dwg.5/10

FS CPI EPI GMPI

FA AB; GI

MC CPI: H08-E04; J01-E03E; L03-E04; L03-H05

EPI: X16-C09; X21-A01F; X21-B01A

L44 ANSWER 21 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2001-600045 [68] WPIX

DNN N2001-447639 DNC C2001-177621

TI Humidification equipment for fuel cells

comprises water permeable **hollow fiber** membranes  
of non-circular section with larger outer flow path than circular  
membranes to exchange moisture between two gases.

DC J01 L03 Q74 X16 X21

PA (HOND) HONDA MOTOR CO LTD

CYC 1

PI JP 2001201121 A 20010727 (200168)\* 10p F24F006-04

ADT JP 2001201121 A JP 2000-10973 20000119

PRAI JP 2000-10973 20000119

IC ICM F24F006-04

ICS B01D053-22; B01D063-02; B01D069-08; F24F006-00

ICA H01M008-04

AB JP2001201121 A UPAB: 20011121

NOVELTY - Several water permeable **hollow fiber**  
membranes (HF) of non-circular cross-sectional shape are stored in a  
longitudinal direction in a casing so that the flow path of gas  
flowing on the outer side is larger than that of circular fiber  
membranes. Exchange of moisture is performed between two gases of  
different moisture contents flowing inside and outside the fiber  
membranes.

DETAILED DESCRIPTION - The gas whose moisture content is low is  
**humidified**, while the gas whose moisture content is high is  
dehumidified according to exchange of moisture content between both  
gases.

USE - For performing **humidification** of solid  
electrolyte type **fuel cells** used as power  
sources in electric vehicles.

ADVANTAGE - The harmony of the characteristics which usually  
conflict can be secured by increasing the surface area of the  
**hollow fiber** membranes and enabling a reduction of  
pressure loss. An improvement in **humidification** capability  
can be achieved and a favorable **humidification** can be  
performed.

DESCRIPTION OF DRAWING(S) - The figure shows a perspective view  
of the structure of non-circular **hollow fiber**

membranes used in humidification equipment.

**Hollow fiber membrane HF**

Dwg.5a,b/9

FS CPI EPI GMPI

FA AB; GI

MC CPI: J01-E01; L03-E04

EPI: X16-C01; X16-C09; X21-A01F; X21-B01A

L44 ANSWER 22 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2001-600044 [68] WPIX

CR 2001-544974 [61]; 2001-544975 [61]

DNN N2001-447638 DNC C2001-177620

TI **Humidifier for fuel cells of electric**

vehicle, has air flow inlet provided on edge of housing along longitudinal direction.

DC H08 J01 L03 Q74 X16 X21

IN KATAGIRI, T; KUSANO, Y; SHIMANUKI, H; SUZUKI, M

PA (HOND) HONDA MOTOR CO LTD; (HOND) HONDA GIKEN KOGYO KK

CYC 2

PI JP 2001201120 A 20010727 (200168)\* 11p F24F006-04

US 6653012 B2 20031125 (200378) H01M002-14

ADT JP 2001201120 A JP 2000-10969 20000119; US 6653012 B2 US 2001-764277 20010119

PRAI JP 2000-10969 20000119; JP 2000-10970 20000119; JP 2000-10971 20000119

IC ICM F24F006-04; H01M002-14

ICS B01D053-22; B01D063-02; F24F006-00; H01M008-04; H01M008-10

AB JP2001201120 A UPAB: 20031203

NOVELTY - Several **hollow fiber** membranes (21b) are arranged inside a housing (21a) along longitudinal direction. The gases of different moisture contents are allowed to flow to the inner and outer surfaces of **hollow fiber** membranes, so that exchange of moisture content between the gases is performed. Air flow inlet (21c) is provided on the edge of housing along longitudinal direction.

USE - For **humidifying** gas discharged from fuel cells used for electric vehicles.

ADVANTAGE - Efficiently exchanges the moisture content at the edge of the housing by spreading the gas which flows at the outer surface of **hollow fiber** pipe through air flow inlet at the edge. Recovers water efficiently.

DESCRIPTION OF DRAWING(S) - The figure shows a sectional view of **hollow fiber** membrane module in **humidifier**.

Housing 21a

**Hollow fiber** membranes 21b

Air flow inlet 21c

Dwg.5/10

FS CPI EPI GMPI  
 FA AB; GI  
 MC CPI: H08-E04; J01-E01; J01-E03E; L03-E04  
 EPI: X16-C01; X16-C09; X21-A01F; X21-B01A

L44 ANSWER 23 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2001-544975 [61] WPIX  
 CR 2001-544974 [61]; 2001-600044 [68]  
 DNN N2001-405081

TI Humidification apparatus for fuel cell  
 , has hollow fiber pipes of water permeability,  
 to exchange moisture content between gases which are made to flow to  
 inner side and outer side of pipes.  
 DC H08 J01 L03 Q74 X16 X21  
 IN KATAGIRI, T; KUSANO, Y; SHIMANUKI, H; SUZUKI, M  
 PA (HOND) HONDA MOTOR CO LTD; (KATA-I) KATAGIRI T; (KUSA-I) KUSANO Y;  
 (SHIM-I) SHIMANUKI H; (SUZU-I) SUZUKI M; (HOND) HONDA GIKEN KOGYO KK

CYC 2  
 PI JP 2001202977 A 20010727 (200161)\* 1lp H01M008-04  
 US 2001021467 A1 20010913 (200161) H01M008-04  
 US 6653012 B2 20031125 (200378) H01M002-14  
 ADT JP 2001202977 A JP 2000-10971 20000119; US 2001021467 A1 US  
 2001-764277 20010119; US 6653012 B2 US 2001-764277 20010119  
 PRAI JP 2000-10971 20000119; JP 2000-10969 20000119; JP 2000-10970  
 20000119

IC ICM H01M002-14; H01M008-04  
 ICS B01D063-02; F02M017-28; F24F006-06; H01M008-10  
 AB JP2001202977 A UPAB: 20031203  
 NOVELTY - Multiple hollow fiber pipes (HF) of  
 water permeability are arranged inside the housing. The gases  
 differing in moisture content are allowed to flow to inner side and  
 outer side of hollow fiber pipes, so that  
 exchange of moisture content between the gases is performed.  
 DETAILED DESCRIPTION - The inner surface of hollow  
 fiber pipes have either protrusions, torsion fins or step  
 portions for turbulent flow.  
 USE - For humidification of fuel  
 cells.  
 ADVANTAGE - Improves the transmission of moisture from moist  
 gas to dried gas by hollow fiber pipes of water  
 permeability. Uniform flow of gases on the inner side of the  
 hollow fiber pipes is obtained because of  
 protrusions.  
 DESCRIPTION OF DRAWING(S) - The figure shows the sectional  
 views of hollow fiber pipes. (Drawing includes  
 non-English language text).  
 Hollow fiber pipes HF  
 Dwg.5/8

FS CPI EPI GMPI

FA AB; GI

MC EPI: X16-C01; X16-C09

L44 ANSWER 24 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2001-544974 [61] WPIX

CR 2001-544975 [61]; 2001-600044 [68]

DNN N2001-405080

TI Humidifier for fuel cell used in electric vehicle, has hollow fiber membranes of water permeability, arranged inside housing having turbulent flow generation grooves, to exchange moisture content between gases.

DC H08 J01 L03 Q74 X16 X21

IN KATAGIRI, T; KUSANO, Y; SHIMANUKI, H; SUZUKI, M

PA (HOND) HONDA MOTOR CO LTD; (HOND) HONDA GIKEN KOGYO KK

CYC 2

PI JP 2001202976 A 20010727 (200161)\* 12p H01M008-04

US 6653012 B2 20031125 (200378) H01M002-14

ADT JP 2001202976 A JP 2000-10970 20000119; US 6653012 B2 US 2001-764277 20010119

PRAI JP 2000-10970 20000119; JP 2000-10969 20000119; JP 2000-10971 20000119

IC ICM H01M002-14; H01M008-04

ICS B01D053-22; B01D063-02; F24F006-06; H01M008-10

AB JP2001202976 A UPAB: 20031203

NOVELTY - Multiple hollow fiber membranes of water permeability are arranged in a housing (31). The gases with different moisture contents, are allowed to flow through the inner side and outer side of hollow fiber membranes, so that exchange of moisture content between the gases is performed. The inner wall surface of the housing is made into turbulent flow generation grooves and protrusions.

USE - For humidifying dried gas in fuel cell used for electric vehicles.

ADVANTAGE - Amount of water recovered from the moist gas is improved due to hollow fiber membranes of water permeability. Uniform flow of gases on the inner surface of hollow fiber membrane is obtained.

DESCRIPTION OF DRAWING(S) - The figure shows the perspective and side views of hollow fiber pipe. (Drawing includes non-English language text).

Housing 31

Dwg.5/13

FS CPI EPI GMPI

FA AB; GI

MC EPI: X16-C01; X16-C09

L44 ANSWER 25 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2001-537290 [60] WPIX  
 DNN N2001-399100  
 TI **Humidifier** has bundles of hollow fiber membranes that can pass water arranged in longitudinal direction of housing, associated heater and flowing gases that exchange water contents.  
 DC Q13 X16 X21  
 IN KATAGIRI, T; KUSANO, Y; SHIMANUKI, H; SUZUKI, M  
 PA (HOND) HONDA GIKEN KOGYO KK; (HOND) HONDA MOTOR CO LTD; (KATA-I) KATAGIRI T; (KUSA-I) KUSANO Y; (SHIM-I) SHIMANUKI H; (SUZU-I) SUZUKI M  
 CYC 3  
 PI DE 10102358 A1 20010823 (200160)\* 22p H01M008-04  
 JP 2001202979 A 20010727 (200160) 11p H01M008-04  
 JP 2001216981 A 20010810 (200160) 7p H01M008-04  
 US 2001015501 A1 20010823 (200160) B01F003-04  
 US 6554261 B2 20030429 (200331) B01F003-04  
 JP 2003156238 A 20030530 (200345) 8p F24F006-10  
 JP 3430402 B2 20030728 (200351) 12p H01M008-04  
 JP 2003178781 A 20030627 (200351) 9p H01M008-04  
 ADT DE 10102358 A1 DE 2001-10102358 20010119; JP 2001202979 A JP 2000-10975 20000119; JP 2001216981 A JP 2000-23220 20000131; US 2001015501 A1 US 2001-764430 20010119; US 6554261 B2 US 2001-764430 20010119; JP 2003156238 A Div ex JP 2000-10975 20000119, JP 2002-232088 20000119; JP 3430402 B2 JP 2000-10975 20000119; JP 2003178781 A Div ex JP 2000-10975 20000119, JP 2002-232089 20000119  
 FDT JP 3430402 B2 Previous Publ. JP 2001202979  
 PRAI JP 2000-23220 20000131; JP 2000-10975 20000119; JP 2002-232088 20000119; JP 2002-232089 20000119  
 IC ICM B01F003-04; F24F006-10; H01M008-04  
 ICS B01D053-22; B01D063-02; B60K001-04; F24F006-00; F24F006-08  
 ICA H01M008-10  
 AB DE 10102358 A UPAB: 20011018  
 NOVELTY - The **humidifier** has a housing (2) with several bundles (21) of hollow fiber membranes that can pass water and that are arranged in the longitudinal direction of the housing. Two different gases with different water content are passed through the inner space and the outer space outside the membranes to exchange their water contents and to **humidify** the gas with the lower water content. A heater feeds heat to the membrane bundles.  
 USE - **Humidifier** for fuel cell system.  
 ADVANTAGE - Can be operated in colder regions without problems.  
 DESCRIPTION OF DRAWING(S) - The drawing shows a schematic perspective representation of a **humidifier** (Drawing includes non-English text)  
 humidifier housing 2

membranes 21  
 distributor 22  
 Dwg.4A/14

FS EPI GMPI  
 FA AB; GI  
 MC EPI: X16-C09; X21-A01F; X21-B01A

L44 ANSWER 26 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2001-520933 [57] WPIX  
 DNN N2001-385860

TI **Humidifier** for fuel cell system used  
 in electric vehicles, has bypass channel with inlet and outlet for  
 respectively introducing and discharging gas flowing outside  
**hollow fiber** membrane.

DC Q74 X16 X21

IN KATAGIRI, T; KUSANO, Y; SHIMANUKI, H; SUZUKI, M  
 PA (HOND) HONDA MOTOR CO LTD; (KATA-I) KATAGIRI T; (KUSA-I) KUSANO Y;  
 (SHIM-I) SHIMANUKI H; (SUZU-I) SUZUKI M

CYC 2

PI US 2001015500 A1 20010823 (200157)\* 17p B01F003-04  
 JP 2001202978 A 20010727 (200158) 11p H01M008-04

ADT US 2001015500 A1 US 2001-764391 20010119; JP 2001202978 A JP  
 2000-10972 20000119

PRAI JP 2000-10972 20000119

IC ICM B01F003-04; H01M008-04  
 ICS B01D053-22; F24F006-06; H01M008-10

AB US2001015500 A UPAB: 20011005

NOVELTY - The **humidifier** (2) has bypass channel formed  
 with an inlet that introduces the gas flowing outside a  
**hollow fiber** membrane into a housing, and an  
 outlet that discharges the gas flowing outside the **hollow**  
**fiber** membrane. The bypass channel has a larger diameter  
 than that of the **hollow fiber** membrane.

DETAILED DESCRIPTION - The bypass channel is formed on the  
 center portion of the housing in cross-lengthwise direction along  
 the housing. INDEPENDENT CLAIMS are also included for the following:

(a) the fuel cell system using the

**humidifier**;

(b) and the **humidification** process.

USE - For fuel cell system used as power  
 source for electric vehicles.

ADVANTAGE - Has improved moisture recovery ratio since  
 sufficient water exchange is performed even at portions near the  
 ends of the **hollow fiber** membranes stored within  
 the housing. Ensures effective moisture exchange and enhanced  
 moisture recovery since gas can be supplied over the entire area of  
 the **hollow fiber** membranes. Performs moisture  
 exchange with higher efficiency.

**DESCRIPTION OF DRAWING(S)** - The figure shows the fuel cell system using the **humidifier**.

**Humidifier 2**

Dwg.1/14

FS EPI GMPI  
 FA AB; GI  
 MC EPI: X16-C01C; X16-C15; X21-A01F; X21-B01A

L44 ANSWER 27 OF 27 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN  
 AN 2001-475429 [51] WPIX  
 DNN N2001-351940

TI Humidifying system for a fuel cell  
 that uses hollow fiber water permeable membranes  
 and a supercharger to supply wet gas to the fuel  
 cell.

DC Q13 X16

IN KATAGIRI, T; KUSANO, Y; SHIMANUKI, H; SUZUKI, M  
 PA (HOND) HONDA MOTOR CO LTD; (HOND) HONDA GIKEN KOGYO KK  
 CYC 2

PI US 2001010871 A1 20010802 (200151)\* 14p HO1M008-02  
 JP 2001216986 A 20010810 (200154) 6p HO1M008-04  
 US 6638651 B2 20031028 (200372) HO1M008-04

ADT US 2001010871 A1 US 2001-774373 20010130; JP 2001216986 A JP  
 2000-23225 20000131; US 6638651 B2 US 2001-774373 20010130

PRAI JP 2000-23225 20000131

IC ICM HO1M008-02; HO1M008-04  
 ICS B60K001-04; HO1M008-10

AB US2001010871 A UPAB: 20010910

NOVELTY - The **humidifying** system takes in outside air through an inlet (11) and gathers moisture from the exhaust gas released by the **fuel cell** (1). Highly wet air is formed in the **humidifier** (4) which communicates with both the piping (5) for air, and the piping (6) for exhaust gas. The highly wet air together with hydrogen is then supplied to the **fuel cell** (1) for the generation of electrical power. The wet air also supplies moisture to the membrane to maintain the water saturated condition.

DETAILED DESCRIPTION - An independent claim is included for a process for **humidifying a fuel cell**.

USE - To maintain good ionic conduction by applying moisture to the solid polymer membrane.

ADVANTAGE - Improved efficiency with reduced size of **humidifier** and supercharger.

DESCRIPTION OF DRAWING(S) - Block diagram of **humidifying** system

Air inlet 1

**Humidifier 4**

Piping 5,6

Air inlet 11

Dwg.1/7

FS EPI GMPI

FA AB; GI

MC EPI: X16-C01C; X16-C15